2024 CFA®
Exam Prep

SchweserNotes™
Equity Valuation

LEVEL II BOOK 3

KAPLAN SCHWESER

Book 3: Equity Valuation

SchweserNotes™ 2024

Level II CFA®

KAPLAN SCHWESER

SCHWESERNOTES™ 2024 LEVEL II CFA® BOOK 3: EQUITY VALUATION

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f. explain and evaluate the effects on private company valuations of discounts and premiums based on control and marketability.

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h. calculate the value of a private company using income-based methods.

i. calculate the value of a private company using market-based methods and describe the advantages and disadvantages of each method.

READING 19

EQUITY VALUATION: APPLICATIONS AND PROCESSES

EXAM FOCUS

This review is simply an introduction to the process of equity valuation and its application. Many of the concepts and techniques introduced are developed more fully in subsequent topic reviews. Candidates should be familiar with the concepts introduced here, including intrinsic value, analyst perception of mispricing, going concern versus liquidation value, and the difference between absolute and relative valuation techniques.

MODULE 19.1: EQUITY VALUATION: APPLICATIONS AND PROCESSES

Video covering this content is available online.

LOS 19.a: Define valuation and intrinsic value and explain sources of perceived mispricing.

Valuation is the process of determining the value of an asset. There are many approaches and estimating the inputs for a valuation model can be quite challenging. Investment success, however, can depend crucially on the analyst's ability to determine the values of securities.

When we use the term **intrinsic value (IV)**, we are referring to the valuation of an asset or security by someone who has complete understanding of the characteristics of the asset or issuing firm. To the extent that stock prices are not perfectly (informationally) efficient, they may diverge from the intrinsic values.

Analysts seeking to produce positive risk-adjusted returns do so by trying to identify securities for which their estimate of intrinsic value differs from current market price. One framework divides mispricing perceived by the analyst into two sources: the difference between market price and the intrinsic value (actual mispricing) and the difference between the analyst's estimate of intrinsic value and actual intrinsic value (valuation error). We can represent this relation as follows:

$$IV_{analyst} - price = (IV_{actual} - price) + (IV_{analyst} - IV_{actual})$$

LOS 19.b: Explain the going concern assumption and contrast a going concern value to a liquidation value.

The **going concern assumption** is simply the assumption that a company will continue to operate as a business, as opposed to going out of business. The valuation models we will cover are all based on the going concern assumption. An alternative, when it cannot be assumed that the company will continue to operate (survive) as a business, is a firm's **liquidation value**. The liquidation value is the estimate of what the assets of the firm would bring if sold separately, net of the company's liabilities.

LOS 19.c: Describe definitions of value and justify which definition of value is most relevant to public company valuation.

As stated earlier, intrinsic value is the most relevant metric for an analyst valuing public equities. However, other definitions of value may be relevant in other contexts. **Fair market value** is the price at which a hypothetical willing, informed, and able seller would trade an asset to a willing, informed, and able buyer. This definition is similar to the concept of fair value used for financial reporting purposes. A company's market price should reflect its fair market value over time if the market has confidence that the company's management is acting in the interest of equity investors.

Investment value is the value of a stock to a particular buyer. Investment value may depend on the buyer's specific needs and expectations, as well as perceived synergies with existing buyer assets.

When valuing a company, an analyst should be aware of the purpose of valuation. For most investment decisions, intrinsic value is the relevant concept of value. For acquisitions, investment value may be more appropriate.

LOS 19.d: Describe applications of equity valuation.

PROFESSOR'S NOTE

This is simply a list of the possible scenarios that may form the basis of an equity valuation question. No matter what the scenario is, the tools you will use are the same.

Valuation is the process of estimating the value of an asset by (1) using a model based on the variables the analyst believes influence the fundamental value of the asset or (2) comparing it to the observable market value of "similar" assets. Equity valuation models are used by analysts in a number of ways. Rather than an end unto itself, valuation is a tool that is used in the pursuit of other objectives like those listed in the following paragraphs.

The general steps in the equity valuation process are:

1. Understand the business.
2. Forecast company performance.
3. Select the appropriate valuation model.
4. Convert the forecasts into a valuation.
5. Apply the valuation conclusions.

Stock selection. The most direct use of equity valuation is to guide the purchase, holding, or sale of stocks. Valuation is based on both a comparison of the intrinsic value of the stock with its market price and a comparison of its price with that of comparable stocks.

Reading the market. Current market prices implicitly contain investors' expectations about the future value of the variables that influence the stock's price (e.g., earnings growth and expected return). Analysts can estimate these expectations by comparing market prices with a stock's intrinsic value.

Projecting the value of corporate actions. Many market professionals use valuation techniques to determine the value of proposed corporate mergers, acquisitions, divestitures, management buyouts (MBOs), and recapitalization efforts.

Fairness opinions. Analysts use equity valuation to support professional opinions about the fairness of a price to be received by minority shareholders in a merger or acquisition.

Planning and consulting. Many firms engage analysts to evaluate the effects of proposed corporate strategies on the firm's stock price, pursuing only those that have the greatest value to shareholders.

Communication with analysts and investors. The valuation approach provides management, investors, and analysts with a common basis upon which to discuss and evaluate the company's performance, current state, and future plans.

Valuation of private business. Analysts use valuation techniques to determine the value of firms or holdings in firms that are not publicly traded. Investors in nonpublic firms rely on these valuations to determine the value of their positions or proposed positions.

Portfolio management. While equity valuation can be considered a stand-alone function in which the value of a single equity position is estimated, it can be more valuable when used in a portfolio management context to determine the value and risk of a portfolio of investments. The investment process is usually considered to have three parts: planning, execution, and evaluation of results. Equity valuation is a primary concern in the first two of these steps.

- *Planning*. The first step of the investment process includes defining investment objectives and constraints and articulating an investment strategy for selecting securities based on valuation parameters or techniques. Sometimes investors may not select individual equity positions, but the valuation techniques are implied in the selection of an index or other preset basket of securities. Active investment managers may use benchmarks as indicators of market expectations and then purposely deviate in composition or weighting to take advantage of their differing expectations.
- *Executing the investment plan*. The valuation of potential investments guides the implementation of an investment plan. The results of the specified valuation methods determine which investments will be made and which will be avoided.

LOS 19.e: Describe questions that should be addressed in conducting an industry and competitive analysis.

The five **elements of industry structure** as developed by Professor Michael Porter are:

1. Threat of new entrants in the industry.
2. Threat of substitutes.
3. Bargaining power of buyers.
4. Bargaining power of suppliers.
5. Rivalry among existing competitors.

The attractiveness (long-term profitability) of any industry is determined by the interaction of these five competitive forces (Porter's five forces).

There are three generic strategies a company may employ in order to compete and generate profits:

1. *Cost leadership:* Being the lowest-cost producer of the good.
2. *Product differentiation:* Addition of product features or services that increase the attractiveness of the firm's product so that it will command a premium price in the market.
3. *Focus:* Employing one of the previous strategies within a particular segment of the industry in order to gain a competitive advantage.

Once the analyst has identified a company's strategy, she can evaluate the performance of the business over time in terms of how well it executes its strategy and how successful it is.

The basic building blocks of equity valuation come from accounting information contained in the firm's reports and releases. In order for the analyst to successfully estimate the value of the firm, the financial factors must be disclosed in sufficient detail and accuracy. Investigating the issues associated with the accuracy and detail of a firm's disclosures is often referred to as a **quality of financial statement information**. This analysis requires examination of the firm's income statement, balance sheet, and the notes to the financial statements. Studies have shown that the quality of earnings issue is reflected in a firm's stock price, with firms with more transparent earnings having higher market values.

An analyst can often only discern important results of management discretion through a detailed examination of the footnotes accompanying the financial reports. Quality of earnings issues can be broken down into several categories and may be addressed only in the footnotes and disclosures to the financial statements.

Accelerating or premature recognition of income. Firms have used a variety of techniques to justify the recognition of income before it traditionally would have been recognized. These include recording sales and billing customers before products are shipped or accepted and bill and hold schemes in which items are billed in advance and held for future delivery. These schemes have been used to obscure declines in operating performance and boost reported revenue and income.

Reclassifying gains and nonoperating income. Firms occasionally have gains or income from sources that are peripheral to their operations. The reclassification of

these items as operating income will distort the results of the firm's continuing operations, often hiding underperformance or a decline in sales.

Expense recognition and losses. Delaying the recognition of expenses, capitalizing expenses, and classifying operating expenses as nonoperating expenses is an opposite approach that has the same effect as reclassifying gains from peripheral sources, increasing operating income. Management also has discretion in creating and estimating reserves that reflect expected future liabilities, such as a bad debt reserve or a provision for expected litigation losses.

Amortization, depreciation, and discount rates. Management has a great deal of discretion in the selection of amortization and depreciation methods, as well as the choice of discount rates in determination of pension plan obligations. These decisions can reduce the current recognition of expenses, in effect deferring recognition to later periods.

Off-balance-sheet issues. The firm's balance sheet may not fully reflect the assets and liabilities of the firm. Special purpose entities (SPEs) can be used by the firm to increase sales (by recording sales to the SPE) or to obscure the nature and value of assets or liabilities. Leases can be structured as operating, rather than finance, leases in order to reduce the total liabilities reported on the balance sheet.

Warning signs of poor earnings quality (and risk of negative earnings surprises) include:

1. Past history of SEC violations, or late filings.
2. Related-party transactions.
3. Excessive loans to officers, employees, or directors.
4. Poor accounting disclosures related to (for example) segmental information or accounting assumptions and policies, and inadequate discussion of negative factors.
5. High management or director turnover.
6. Consulting services provided by an audit firm.
7. Disputes with and/or changes in auditors.
8. Executive compensation tied to profitability or stock price.
9. Declining margins or market share.
10. Pressure to meet debt covenants or earnings expectations.

LOS 19.f: Contrast absolute and relative valuation models and describe examples of each type of model.

Absolute valuation models. An absolute valuation model is one that estimates an asset's intrinsic value, which is its value arising from its investment characteristics without regard to the value of other firms. One absolute valuation approach is to determine the value of a firm today as the *discounted* or *present value* of all the cash flows expected in the future. *Dividend discount models* estimate the value of a share based on the present value of all expected dividends discounted at the opportunity cost of capital. Many analysts realize that equity holders are entitled to more than

just the dividends and so expand the measure of cash flow to include all expected cash flow to the firm that is not payable to senior claims (bondholders, taxing authorities, and senior stockholders). These models include the free cash flow approach and the residual income approach.

Another absolute approach to valuation is represented by *asset-based* models. This approach estimates a firm's value as the sum of the market value of the assets it owns or controls. This approach is commonly used to value firms that own or control natural resources, such as oil fields, coal deposits, and other mineral claims.

Relative valuation models. Another very common approach to valuation is to determine the value of an asset in relation to the values of other assets. This is the approach underlying relative valuation models. The most common models use market price as a multiple of an individual financial factor of the firm, such as earnings per share. The resulting ratio, price-to-earnings (P/E), is easily compared to that of other firms. If the P/E is higher than that of comparable firms, it is said to be *relatively* overvalued, that is, overvalued relative to the other firms (not necessarily overvalued on an intrinsic value basis). The converse is also true: if the P/E is lower than that of comparable firms, the firm is said to be relatively undervalued.

LOS 19.g: Describe sum-of-the-parts valuation and conglomerate discounts.

Rather than valuing a company as a single entity, an analyst can value individual parts of the firm and add them up to determine the value for the company as a whole. The value obtained is called the *sum-of-the-parts value,* or sometimes *breakup value* or *private market value*. This process is especially useful when the company operates multiple divisions (or product lines) with different business models and risk characteristics (i.e., a conglomerate).

Conglomerate discount is based on the idea that investors apply a markdown to the value of a company that operates in multiple unrelated industries, compared to the value a company that has a single industry focus. Conglomerate discount is thus the amount by which market value under-represents sum-of-the-parts value.

Three explanations for conglomerate discounts are:

1. Internal capital inefficiency: The company's allocation of capital to different divisions may not have been based on sound decisions.
2. Endogenous (internal) factors: For example, the company may have pursued unrelated business acquisitions to hide poor operating performance.
3. Research measurement errors: Some hypothesize that conglomerate discounts do not exist, but rather are a result of incorrect measurement.

LOS 19.h: Explain broad criteria for choosing an appropriate approach for valuing a given company.

When selecting an approach for valuing a given company, an analyst should consider whether the model:

- Fits the characteristics of the company (e.g., Does it pay dividends? Is earnings growth estimable? Does it have significant intangible assets?).
- Is appropriate based on the quality and availability of input data.
- Is suitable given the purpose of the analysis.

The purpose of the analysis may be, for example, valuation for making a purchase offer for a controlling interest in the company. In this case, a model based on cash flow may be more appropriate than one based on dividends because a controlling interest would allow the purchaser to set dividend policy.

One thing to remember with respect to choice of a valuation model is that the analyst does not have to consider only one. Using multiple models and examining differences in estimated values can reveal how a model's assumptions and the perspective of the analysis are affecting the estimated values.

MODULE QUIZ 19.1

1. Susan Weiber, CFA, has noted that even her best estimates of a stock's intrinsic value can differ significantly from the current market price. The *least likely* explanation is differences between:
   A. her estimate and the actual intrinsic value.
   B. the actual intrinsic value and the market price.
   C. the intrinsic value and the going concern value.
2. For a company for which the going-concern assumption is not valid, the *most appropriate* valuation approach would be to calculate its:
   A. residual income model value.
   B. dividend discount model value.
   C. liquidation value.
3. Davy Jarvis, CFA, is performing an equity valuation as part of the planning and execution phase of the portfolio management process. His results will also be useful for:
   A. communication with analysts and investors.
   B. technical analysis.
   C. benchmarking.
4. The five elements of industry structure, as outlined by Michael Porter, include:
   A. threat of substitutes.
   B. rivalry among buyers.
   C. bargaining power of competitors.
5. Tom Walder has been instructed to use absolute valuation models, and not relative valuation models, in his analysis. Which of the following is *least likely* to be an example of an absolute valuation model?
   A. The dividend discount model.
   B. The price-to-earnings market multiple model.
   C. The residual income model.
6. Davy Jarvis, CFA, is performing an equity valuation and reviews his notes for key points he wanted to cover when planning the valuation. He finds the following questions:
   - Does the company pay dividends?
   - Is earnings growth estimable?
   - Does the company have significant intangible assets?

   Which of the following general questions is Jarvis trying to answer when planning this phase of the valuation?

A. Does the model fit the characteristics of the investment?
B. Is the model appropriate based on the availability of input data?
C. Can the model be improved to make it more suitable, given the purpose of the analysis?

Use the following information to answer Questions 7 and 8.

Sun Pharma is a large pharmaceutical company based in Sri Lanka that manufactures prescription drugs under license from large multinational pharmaceutical companies. Delenga Mahamurthy, CEO of Sun Pharma, is evaluating a potential acquisition of Island Cookware, a small manufacturing company that produces cooking utensils.

Mahamurthy feels that Sun Pharma's excellent distribution network could add value to Island Cookware. Sun Pharma plans to acquire Island Cookware for cash. Several days later, Sun Pharma announces that they have acquired Island Cookware at market price.

7. Sun Pharma's *most appropriate* valuation for Island Cookware is its:
   A. sum-of-the-parts value.
   B. investment value.
   C. liquidation value.
8. Upon announcement of the merger, the market price of Sun Pharma drops. This is *most likely* a result of the:
   A. unrelated business effect.
   B. tax effect.
   C. conglomerate discount.

KEY CONCEPTS

LOS 19.a

Intrinsic value is the value of an asset or security estimated by someone who has complete understanding of the characteristics of the asset or issuing firm. To the extent that market prices are not perfectly (informationally) efficient, they may diverge from intrinsic value. The difference between the analyst's estimate of intrinsic value and the current price is made up of two components: the difference between the actual intrinsic value and the market price, and the difference between the actual intrinsic value and the analyst's estimate of intrinsic value:

$$IV_{analyst} - price = (IV_{actual} - price) + (IV_{analyst} - IV_{actual})$$

LOS 19.b

The going concern assumption is simply the assumption that a company will continue to operate as a business as opposed to going out of business. The liquidation value is the estimate of what the assets of the firm would bring if sold separately, net of the company's liabilities.

LOS 19.c

Fair market value is the price at which a hypothetical willing, informed, and able seller would trade an asset to a willing, informed and able buyer.

Investment value is the value to a specific buyer after including any additional value attributable to synergies. Investment value is an appropriate measure for strategic

buyers pursuing acquisitions.

LOS 19.d

Equity valuation is the process of estimating the value of an asset by (1) using a model based on the variables the analyst believes influence the fundamental value of the asset or (2) comparing it to the observable market value of "similar" assets. Equity valuation models are used by analysts in a number of ways. Examples include stock selection, reading the market, projecting the value of corporate actions, fairness opinions, planning and consulting, communication with analysts and investors, valuation of private business, and portfolio management.

LOS 19.e

The five elements of industry structure as developed by Professor Michael Porter are:

1. Threat of new entrants in the industry.
2. Threat of substitutes.
3. Bargaining power of buyers.
4. Bargaining power of suppliers.
5. Rivalry among existing competitors.

Quality of earnings issues can be broken down into several categories:

- Accelerating or premature recognition of income.
- Reclassifying gains and nonoperating income.
- Expense recognition and losses.
- Amortization, depreciation, and discount rates.
- Off-balance-sheet issues.

It may be that these issues are addressed only in the footnotes and disclosures to the financial statements.

LOS 19.f

An absolute valuation model is one that estimates an asset's intrinsic value (e.g., the discounted dividend approach). Relative valuation models estimate an asset's investment characteristics compared to the value of other firms (e.g., comparing P/E ratios to those of other firms in the industry).

LOS 19.g

Sum-of-the-parts valuation is the process of valuing the individual components of a company and then adding these values together to obtain the value of the whole company. Conglomerate discount refers to the amount by which market price is lower than the sum-of-the-parts value. Conglomerate discount is an apparent price reduction applied by the markets to firms that operate in multiple industries.

LOS 19.h

When selecting an approach for valuing a given company, an analyst should consider whether the model fits the characteristics of the company, is appropriate based on

the quality and availability of input data, and is suitable, given the purpose of the analysis.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 19.1

1. **C** The difference between the analyst's estimate of intrinsic value and the current price is made up of two components:
   $IV_{analyst} - price = (IV_{actual} - price) + (IV_{analyst} - IV_{actual})$
   (LOS 19.a)

2. **C** The liquidation value is the estimate of what the assets of the firm will bring when sold separately, net of the company's liabilities. It is most appropriate when the firm is not a going concern and will not pay dividends. The residual income model is based on the going concern assumption, and is not appropriate for valuing a firm that is expected to go out of business. (LOS 19.b)

3. **A** Communication with analysts and investors is one of the common uses of an equity valuation. Technical analysis and benchmarking do not require equity valuation. (LOS 19.d)

4. **A** The five elements of industry structure as developed by Professor Michael Porter are:
   1. Threat of new entrants in the industry.
   2. Threat of substitutes.
   3. Bargaining power of buyers.
   4. Bargaining power of suppliers.
   5. Rivalry among existing competitors.

   (LOS 19.e)

5. **B** Absolute valuation models estimate value as some function of the present value of future cash flows (e.g., dividend discount and free cash flow models) or economic profit (e.g., residual income models). Relative valuation models estimate an asset's value relative to the value of other similar assets. The price-to-earnings market multiple model is an example of a relative valuation model. (LOS 19.f)

6. **A** Jarvis is most likely trying to be sure the selected model fits the characteristics of the investment. Model selection will depend heavily on the answers to these questions. (LOS 19.f)

7. **B** The appropriate valuation for Sun Pharma's acquisition is the investment value, which incorporates the value of any synergies present in the acquisition. Sum-of-the-parts value is not applicable, as the valuation does not require separate valuation of different divisions of Island Cookware. Liquidation value is also not relevant, as Sun Pharma does not intend to liquidate the assets of Island Cookware. (LOS 19.c)

8. **C** Upon announcement of the acquisition, the market price of Sun Pharma should not change if the acquisition was at fair value. However, the market is valuing

the whole company at a value less than the value of its parts: this is a conglomerate discount. We are not given any information about tax consequences of the merger and hence a tax effect is unlikely to be the cause of the market price drop. The acquisition of an unrelated business may result in a conglomerate discount, but there is no defined 'unrelated business effect.' (LOS 19.c)

READING 20

DISCOUNTED DIVIDEND VALUATION

EXAM FOCUS

This topic review presents the use of dividend discount models, one of the classes of models using the present value of future cash flows to determine the value of a stock. Dividend discount models use forecasted dividends as the estimate of cash flow to the shareholder. This material has several important topics that will require careful study. You should be able to choose the appropriate model for the firm to be valued (based on the pattern of expected dividend growth), forecast the future dividends to be discounted, and determine the appropriate discount rate to apply. You should also understand the concept of sustainable growth and be able to estimate a firm's sustainable growth rate.

MODULE 20.1: DDM BASICS

Video covering this content is available online.

LOS 20.a: Compare dividends, free cash flow, and residual income as inputs to discounted cash flow models and identify investment situations for which each measure is suitable.

In stock valuation models, there are three predominant definitions of future cash flows: dividends, free cash flow, and residual income.

Dividends. Dividend discount models (DDMs) define cash flow as the dividends to be received by the shareholders. The *primary advantage* of using dividends as the definition of cash flow is that it is theoretically justified. The shareholder's investment today is worth the present value of the future cash flows he expects to receive, and ultimately he will be repaid for his investment in the form of dividends. Even if the investor sells the stock at any time prior to the liquidation of the company, before all the dividends are paid, he will receive from the buyer of the shares the present value of the expected future dividends.

An *additional advantage* of dividends as a measure of cash flow is that dividends are less volatile than other measures (earnings or free cash flow), and therefore the value estimates derived from dividend discount models are less volatile and reflect the long-term earning potential of the company.

The *primary disadvantage* of dividends as a cash flow measure is that it is difficult to implement for firms that don't currently pay dividends. It is *possible* to estimate

expected future dividends by forecasting the point in the future when the firm is expected to begin paying dividends. The problem with this approach in practice is the uncertainty associated with forecasting the fundamental variables that influence stock price (earnings, dividend payout rate, growth rate, and required return) so far into the future.

A *second disadvantage* of measuring cash flow with dividends is that it takes the perspective of an investor who owns a minority stake in the firm and cannot control the dividend policy. If the dividend policy dictated by the controlling interests bears a meaningful relationship to the firm's underlying profitability, then dividends are appropriate. However, if the dividend policy is *not* related to the firm's ability to create value, then dividends are not an appropriate measure of expected future cash flow to shareholders.

Dividends are appropriate as a measure of cash flow in the following cases:

- The company has a *history of dividend payments*.
- The dividend policy is clear and *related to the earnings of the firm*.
- The *perspective* is that of a *minority shareholder*.

Firms in the mature stage of the industry life cycle are most likely to meet the first two criteria.

EXAMPLE: Identifying the appropriate valuation model

Based on the financial information on Eastern Consolidated, Inc., provided in the following table, determine whether or not a dividend discount model is the appropriate model to value Eastern Consolidated common stock.

Earnings and Dividend Data for Eastern Consolidated

	2022	2021	2020	2019	2018
Earnings per share	$7.50	$6.25	$5.85	$5.40	$5.00
Dividends per share	$1.25	$1.25	$1.25	$1.25	$1.25

Answer:

Earnings have grown at a compound rate of $(\$7.50 / \$5.00)^{1/4} - 1 = 0.107 = 10.7\%$ over the four years while dividends have been constant, resulting in a decrease in the dividend payout ratio. A dividend discount model is not appropriate in this case because the firm's dividend policy is not consistent with its profitability trend.

Free cash flow. *Free cash flow to the firm (FCFF)* is defined as the cash flow generated by the firm's operations that is in excess of the capital investment required to sustain the firm's current productive capacity. *Free cash flow to equity (FCFE)* is the cash available to stockholders after funding capital requirements and expenses associated with debt financing.

One advantage of free cash flow models is that they can be applied to many firms, regardless of dividend policies or capital structures. The ability to influence the distribution and application of a firm's free cash flow makes these models more

pertinent to a firm's controlling shareholders. Free cash flow is also useful to minority shareholders because the firm may be acquired for a market price equal to the value to the controlling party.

However, there are cases in which the application of a free cash flow model may be very difficult. Firms that have significant capital requirements may have negative free cash flow for many years into the future. This can be caused by a technological revolution in an industry that requires greater investment to remain competitive or by rapid expansion into untapped markets. This negative free cash flow complicates the cash flow forecast and makes the estimates less reliable.

Free cash flow models are most appropriate:

- For firms that do not have a dividend payment history or have a dividend payment history that is not clearly and appropriately related to earnings.
- For firms with free cash flow that corresponds with their profitability.
- When the valuation perspective is that of a controlling shareholder.

PROFESSOR'S NOTE
See the next topic review for details on free cash flow models.

Residual income. Residual income is the amount of earnings during the period that exceeds the investors' required return. The theoretical basis for this approach is that the required return is the opportunity cost to the suppliers of capital, and the residual income is the amount that the firm is able to generate in excess of this return. The residual income approach can be applied to firms with negative free cash flow and to dividend- and non-dividend-paying firms.

Residual income models can be more difficult to apply, however, because they require in-depth analysis of the firm's accounting accruals. Management discretion in establishing accruals for both income and expense may obscure the true results for a period. If the accounting is not transparent or if the quality of the firm's reporting is poor, the accurate estimation of residual income is likely to be difficult.

The residual income approach is most appropriate for:

- Firms that do not have dividend histories.
- Firms that have negative free cash flow for the foreseeable future (usually due to capital demands).
- Firms with transparent financial reporting and high-quality earnings.

PROFESSOR'S NOTE
Residual income models are addressed later in the Equity Valuation portion of the curriculum.

LOS 20.b: Calculate and interpret the value of a common stock using the dividend discount model (DDM) for single and multiple holding periods.

One-Period DDM

We can rearrange the holding period formula to solve for the value today of the stock given the expected dividend, the expected price in one year, and the required

return:

$$V_0 = \frac{D_1 + P_1}{1 + r}$$

where:
V_0 = fundamental value
D_1 = dividends expected to be received at end of Year 1
P_1 = price expected upon sale at end of Year 1
r = required return on equity

EXAMPLE: Calculating value for a one-period DDM

BuyBest shares are expected to pay a dividend at the end of the year of €1.25. The analyst estimates the required return to be 8% and the expected price at the end of the year to be €28.00. The current price is €26.00. Calculate the value of the shares today, and determine whether BuyBest is overvalued, undervalued, or properly valued.

Answer:

The current value of the shares according to the DDM is equal to:

$$V_0 = \frac{€1.25 + €28.00}{1.08} = €27.08$$

BuyBest is undervalued. The current market price of €26.00 is less than the fundamental value of €27.08.

Two-Period DDM

The value of a share of stock using the two-period DDM is the present value of the dividends in Years 1 and 2, plus the present value of the expected price in Year 2:

$$V_0 = \frac{D_1}{(1 + r)^1} + \frac{D_2 + P_2}{(1 + r)^2}$$

where:
V_0 = fundamental value
D_1 = dividends expected to be received at end of Year 1
D_2 = dividends expected to be received at end of Year 2
P_2 = price expected upon sale at end of Year 2
r = required return on equity

EXAMPLE: Calculating value for a two-period DDM

Machines Unlimited shares are expected to pay dividends of 1.55 Canadian dollars (C$) and C$1.72 at the end of each of the next two years, respectively. The investor expects the price of the shares at the end of this 2-year holding period to be C$42.00. The investor's required rate of return is 14%. Calculate the current value of Machines Unlimited shares.

Answer:

The value of Machines Unlimited shares can be determined with a two-period DDM as:

$$\frac{C\$1.55}{1.14^1} + \frac{C\$1.72 + C\$42.00}{1.14^2} = C\$35.00$$

Multi-Period DDM

The DDM can easily be adapted to any number of holding periods by adjusting the discount factor to match the time to receipt of each expected return. With this, the present value becomes the sum of the properly discounted values of all expected cash flows (dividends and terminal value):

$$V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_n + P_n}{(1+r)^n}$$

where:
V_0 = fundamental value
D_i = dividends expected to be received at end of year i, i = 1 to n
P_n = price expected upon sale at end of year n
r = required return on equity
n = length of holding period

For example, if we extend the holding period to three years, we simply extend the formula.

EXAMPLE: Calculating value for a three-period DDM

Reliable Motors shares are expected to pay dividends of $1.50, $1.60, and $1.75 at the end of each of the next three years, respectively. The investor expects the price of the shares at the end of this 3-year holding period to be $54.00. The investor's required rate of return is 15%. Calculate the current value of Reliable's shares.

Answer:

The value of Reliable Motors shares can be determined with a multi-period DDM as:

$$\frac{\$1.50}{1.15^1} + \frac{\$1.60}{1.15^2} + \frac{\$1.75 + \$54.00}{1.15^3} = \$39.17$$

When we have to calculate the total of three or more discounted cash flows, we can generally save a considerable amount of time (and improve accuracy) by using our financial calculators as shown in the following table:

Calculating the PV of Multiple Cash Flows With the TI BA II Plus™

Key Strokes	Explanation	Display
[CF] → [2nd] → [CLR WORK]	Clear memory registers	$CF_0 = 0$
[ENTER]	Initial cash outlay	$CF_0 = 0$
[↓]→1.50→ [ENTER]	Year 1 cash flow	C01 = 1.50
[↓]	Frequency of cash flow 1	F01 = 1
[↓]→1.60→ [ENTER]	Year 2 cash flow	C02 = 1.60
[↓]	Frequency of cash flow 2	F02 = 1
[↓]→55.75→ [ENTER]	Year 3 cash flow	C03 = 55.75
[↓]	Frequency of cash flow 3	F03 = 1
[↓][NPV] →15→[ENTER]	15% discount rate	I = 15
[↓]→ [CPT]	Calculate NPV of all CFs	NPV= 39.17

Warm-Up: The General Dividend Discount Model

If we extend the holding period indefinitely, the value simply becomes the present value of an infinite stream of dividends, represented by John Burr Williams's (1938) original DDM formula:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$$

While the DDM is theoretically correct, applying it in practice requires the analyst to accurately forecast dividends for many periods, a task for which we rarely can expect to have sufficient information. We can use one of several growth models, including the:

- Gordon *constant* growth model.
- *Two-stage* growth model.
- *H*-model.
- *Three-stage* growth model.

With the appropriate model, we can forecast dividends up to the end of the investment horizon where we no longer have confidence in the forecasts and then forecast a terminal value based on some other method, such as a multiple of book value or earnings. Choosing the appropriate growth model is essential to accurate forecasts.

MODULE QUIZ 20.1

1. Restoration Software is a growth stock that has never paid a dividend. Free cash flow is forecasted to be negative for the next five years because of Restoration's aggressive expansion plans. Restoration has always received an unqualified opinion from its auditors and is generally considered to have high-quality earnings. Which of the following models is *most appropriate* to value Restoration?
   A. Free cash flow to the firm model.
   B. Free cash flow to equity model.
   C. Residual income model.

MODULE 20.2: GORDON GROWTH MODEL

Video covering this content is available online.

LOS 20.c: Calculate the value of a common stock using the Gordon growth model and explain the model's underlying assumptions.

The **Gordon growth model (GGM)** assumes that *dividends increase at a constant rate indefinitely*. The simplifying factor of the constant growth assumption is that the rate of growth can be expressed per period in the same way that the required return is expressed, allowing the expression to be condensed into a simple formula:

$$V_0 = \frac{D_0 \times (1+g)^1}{(1+r)^1} + \frac{D_0 \times (1+g)^2}{(1+r)^2} + \frac{D_0 \times (1+g)^3}{(1+r)^3} + \ldots + \frac{D_0 \times (1+g)^n}{(1+r)^n}$$

which condenses to:

$$V_0 = \frac{D_0 \times (1+g)}{r-g} = \frac{D_1}{r-g}$$

where:
V_0 = fundamental value
D_0 = dividend just paid
D_1 = dividends expected to be received at end of Year 1
r = required return on equity
g = dividend growth rate

The model assumes that:

- The firm expects to pay a dividend, D_1, in one year.
- Dividends grow indefinitely at a constant rate, g (which may be less than zero).
- The growth rate, g, is less than the required return, r.

A firm's growth rate projections can be compared to the growth rate of the economy to determine if it can continue indefinitely. It is unrealistic to assume that any firm can continue to grow indefinitely at a rate higher than the long-term growth rate in real gross domestic product (GDP) plus the long-term inflation rate. In general, a perpetual dividend growth rate forecast above 5% is suspect.

EXAMPLE: Calculating value with the Gordon growth model

DownUnder Financial recently paid a dividend of 1.80 Australian dollars (A$). An analyst has examined the financial statements and historical dividend policy of DownUnder and expects that the firm's dividend rate will grow at a constant rate of 3.5% indefinitely. The analyst also determines DownUnder's beta is 1.5, the risk-free rate is 4%, and the expected return on the market portfolio is 8%. Calculate the current value of DownUnder's shares.

Answer:

First use the capital asset pricing model (CAPM) to estimate DownUnder's required return:

$$r = 4\% + [1.5 \times (8\% - 4\%)] = 10\%$$

Then use the Gordon growth model to estimate share value:

$$V_0 = \frac{A\$1.80 \times 1.035}{0.10 - 0.035} = \frac{A\$1.863}{0.10 - 0.035} = A\$28.66$$

PROFESSOR'S NOTE

The dividend to be discounted is the next period dividend, D_1, not the dividend from the previous period, D_0. Use either $D_0 \times (1+g)$ or D_1 in the numerator, depending on whether you're given the most recent dividend paid (D_0) or the expected dividend in one year (D_1).

When companies have share repurchase programs, an analyst can focus on total payout (i.e., dividends plus repurchases) and use that in their valuation model. Alternatively, dividend discount models focusing on cash dividends can also be used, after adjusting for the number of shares outstanding (taking share repurchases into account).

LOS 20.d: Calculate the value of non-callable fixed-rate perpetual preferred stock.

A firm that has no additional opportunities to earn returns in excess of the required rate of return should distribute all of its earnings to shareholders in the form of dividends. Under this assumption the growth rate would be zero, and the current value of the firm would be equal to the current dividend divided by the required rate of return. This is exactly the same approach used to determine the value of fixed-rate perpetual preferred shares.

$$\text{value of perpetual preferred shares} = \frac{D_p}{r_p}$$

where:
D_p = preferred dividend (which is assumed not to grow)
r_p = cost of preferred equity

EXAMPLE: Calculating the value of fixed-rate perpetual preferred stock

United Publishing has a fixed-rate perpetual preferred stock outstanding with a dividend of 6% (based on an issue at par of £100). If the investors' required rate of return for holding these shares is 9.5%, calculate the current value of these shares.

Answer:

Dividends are not growing because the preferred dividend is based on a fixed rate of 6.0% on a stated par value of £100, so this is comparable to DDM with a fixed dividend in perpetuity.

$$D = 0.06 \times £100.00 = £6.00$$

$$\text{value of preferred shares} = \frac{£6.00}{0.095} = £63.16$$

LOS 20.e: Describe strengths and limitations of the Gordon growth model and justify its selection to value a company's common shares.

The Gordon growth model (GGM) has a number of characteristics that make it useful and appropriate for many applications. The model:

- Is applicable to stable, mature, dividend-paying firms.
- Is appropriate for valuing market indices.
- Is easily communicated and explained because of its straightforward approach.
- Can be used to determine price-implied growth rates, required rates of return, and value of growth opportunities.
- Can be used to supplement other, more complex valuation methods.

There are also some characteristics that limit the applications of the GGM:

- Valuations are very sensitive to estimates of growth rates and required rates of return, both of which are difficult to estimate with precision.
- The model cannot be easily applied to non-dividend-paying stocks.
- Unpredictable growth patterns of some firms would make using the model difficult and the resulting valuations unreliable.

LOS 20.f: Calculate and interpret the implied growth rate of dividends using the Gordon growth model and current stock price.

The Gordon growth model includes four variables, so if we know any three of them, we can solve for the fourth. In practice, we can typically observe the price and current dividend for a publicly traded stock. Consequently, we are usually interested in either backing out the implied required return, using an assumed growth rate, or the implied growth rate, using an assumed required return. In this example, we calculate the implied growth rate using an estimated return.

EXAMPLE: Calculating the implied growth rate using the Gordon growth model

Suppose that the current price and most recent annual dividend for Aurora Mining (AM) are $24.25 and $1.10, respectively. If the required return on Aurora is 8.5%, what is the implied growth rate?

Answer:

We can set up the Gordon growth model in its standard form using the information we know:

$$P_0 = \frac{D_0(1+g)}{r-g} = \frac{1.10(1+g)}{(0.085-g)} = \$24.25$$

Rearranging the terms gives us:

$$1.10 + 1.10g = 2.06125 - 24.25g$$

$$25.35g = 0.96125$$

$$g = 0.0379$$

So, assuming that our estimated required return is on target, the implied growth rate for Aurora Mining's dividends is 3.8%.

PROFESSOR'S NOTE
Also be prepared to solve for the implied required return given the other variables in the model.

LOS 20.g: Calculate and interpret the present value of growth opportunities (PVGO) and the component of the leading price-to-earnings ratio (P/E) related to PVGO.

A firm that has additional opportunities to earn returns in excess of the required rate of return would benefit from retaining earnings and investing in those growth opportunities rather than paying out dividends. The fundamental value then represents not only the present value of the future dividends (on a non-growth basis) but also the present value of the growth opportunities (PVGO):

$$V_0 = \frac{E_1}{r} + PVGO$$

where:
E_1 = earnings at t = 1
r = required return on equity

This means the value of a firm's equity has two components:

- The value of its assets in place (E_1/r), which is the present value of a perpetual cash flow of E_1.
- The present value of its future investment opportunities (PVGO).

A substantial portion of the value of growth companies is in their PVGO. In contrast, companies in slow-growth industries (e.g., utilities) have low PVGO, and most of their value comes from their assets in place.

EXAMPLE: Calculating PVGO

Reliable, Inc.'s shares trade at 60.00 Swiss francs (Sf) with expected earnings of Sf 5.00 per share and a required return of 10%. Suppose that the shares are properly priced, so price is equal to fundamental value. Calculate the PVGO and the portion of the leading P/E related to PVGO.

Answer:

$$V_0 = \frac{E_1}{r} + PVGO$$

$$Sf60 = \frac{Sf5.00}{0.10} + PVGO \Rightarrow PVGO = Sf10.00$$

P/E firm = Sf60/5 = 12x

P/E PVGO = Sf10/5 = 2x

2/12 or 16.7% of the firm's leading P/E ratio is attributable to PVGO.

LOS 20.h: Calculate and interpret the justified leading and trailing P/Es using the Gordon growth model.

The price-to-earnings (P/E) ratio is the most commonly used relative valuation indicator. An analyst derives a **justified P/E** based on the firm's fundamentals. The two most common forms are the **leading P/E**, which is based on the earnings forecast for the next period, and the **trailing P/E**, which is based on the earnings for the previous period. Both of these can be derived from the DDM:

$$\text{justified leading P/E} = \frac{P_0}{E_1} = \frac{D_1/E_1}{r-g} = \frac{1-b}{r-g}$$

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{D_0 \times (1+g)/E_0}{r-g} = \frac{(1-b) \times (1+g)}{r-g}$$

where:

P_0 = fundamental value
D_0 = dividends just paid
D_1 = dividends expected to be received in one year
E_0 = current earnings
E_1 = earnings expected in one year
b = retention ratio
$(1-b)$ = dividend payout ratio
g = dividend growth rate

PROFESSOR'S NOTE

The notation is tricky here. Because these are justified P/E ratios, the "price" in the numerator is actually the fundamental value of the stock derived from the Gordon growth model. It would be more accurate to label these ratios V_0 / E_0 and V_0 / E_1, but the common convention is to call them "justified P/Es."

EXAMPLE: Calculating justified leading and trailing P/E

Alliance, Inc., is currently selling for $16.00 on current earnings of $3.00 and a current dividend of $1.50. Dividends are expected to grow at 3.5% per year indefinitely. The risk-free rate is 4%, the market equity risk premium is 6%, and Alliance's beta is estimated to be 1.1. Calculate the justified leading and trailing P/E ratios of Alliance, Inc.

Answer:

$$\text{required return} = 4.0\% + (1.1 \times 6.0\%) = 10.6\%$$

$$\text{retention ratio} = b = \frac{\text{earnings} - \text{dividends}}{\text{earnings}} = \frac{\$3.00 - \$1.50}{\$3.00} = 0.5$$

$$\text{payout ratio} = (1 - b) = \frac{\text{dividends}}{\text{earnings}} = \frac{\$1.50}{\$3.00} = 0.5$$

$$\text{justified leading P/E} = \frac{1 - b}{r - g} = \frac{0.5}{0.106 - 0.035} = 7.04$$

$$\text{justified trailing P/E} = \frac{(1 - b) \times (1 + g)}{r - g} = \frac{0.5 \times 1.035}{0.106 - 0.035} = 7.29$$

$$\text{or justified trailing P/E} = 7.04 \times (1.035) = 7.29$$

PROFESSOR'S NOTE

Remember that if earnings are expected to grow, E_1 will be greater than E_0, and the justified leading P/E (P_0 / E_1) will be smaller than the justified trailing P/E (P_0 / E_0) because you're dividing by a larger number when you are calculating leading P/E. In fact, trailing P/E will be larger than leading P/E by a factor of (1 + g): justified trailing P/E = justified leading P/E × (1 + g).

Next we discuss multistage growth models, which accommodate more realistic growth rate assumptions.

MODULE QUIZ 20.2

1. JCI, Inc., pays an annual dividend of 5.00 Canadian dollars (C$). The company is expected to continue paying this dividend with no future growth in dividends. Investors require a 9% rate of return on this investment. The current risk-free rate is 4%. The current stock value of JCI, Inc., is *closest* to:
   A. C$55.56.
   B. C$100.00.
   C. C$125.00.

2. The current stock price of MCD is $89.00. The current dividend for MCD is $2.50, and dividends are expected to grow at a constant rate of 8%. The implied required return for MCD is *closest* to:
   A. 3%.
   B. 8%.
   C. 11%.

3. CFCRegs, Inc., just paid a dividend of $2.00 per share. The required return is 13%, and the stock is currently trading at $30.28 per share. The growth rate implied by the Gordon growth model is *closest* to:
   A. 4%.
   B. 6%.
   C. 8%.

4. Video Discs Forever, Inc., manufactures and distributes a line of DVD players. The company has fallen on hard times and although it will pay a $4 dividend in the next period, it expects dividends to decline by 3% per year thereafter. If the discount rate for the company is 9%, the current value of one share of VDF's common stock is *closest* to:
   A. $33.33.
   B. $44.44.

C. $66.67.

5. Titan Industries is not expected to pay a dividend until ten years from now, at which time it is expected to pay a dividend of $1.25 and increase the dividend at a rate of 4% thereafter. If the required rate of return is 12%, the current value of Titan is *closest* to:
   A. $5.64.
   B. $12.78.
   C. $15.63.

6. EBEE is expected to grow at a rate of 30% for the next five years. After that, competition is expected to lower EBEE's growth to a constant 7% indefinitely. The market risk premium is 6%, and the risk-free rate is 5%. EBEE's beta is 1.2, and the company just paid a dividend of $2.50. The current stock value of EBEE is *closest* to:
   A. $127.28.
   B. $154.57.
   C. $191.00.

MODULE 20.3: MULTIPERIOD MODELS

Video covering this content is available online.

LOS 20.k: Explain the growth phase, transition phase, and maturity phase of a business.

While the basic GGM assumes constant growth, most firms go through a pattern of growth that includes several phases:

- An *initial growth phase*, where the firm has rapidly increasing earnings, little or no dividends, and heavy reinvestment.
- A *transition phase*, in which earnings and dividends are still increasing but at a slower rate as competitive forces reduce profit opportunities and the need for reinvestment.
- A *mature phase*, in which earnings grow at a stable but slower rate, and payout ratios are stabilizing as reinvestment matches depreciation and asset maintenance requirements.

The level and pattern of specific fundamental variables during the three phases, as well as the appropriate valuation model to apply in each phase, are shown in Figure 20.1.

Figure 20.1: Growth, Transition, and Maturity Phase

Variable	Growth Phase		
	Initial Growth	**Transition**	**Maturity**
Earnings Growth	Very high	Above average but falling	Stable at long-run level
Capital Investment	Significant requirements	Decreasing	Stable at long-run level
Profit Margin	High	Above average but falling	Stable at long-run level
FCFE	Negative	May be positive, and growing	Stable at long-run level
ROE vs. Required Return	ROE > r	ROE approaching r	ROE = r
Dividend Payout	Low or zero	Increasing	Stable at long-run level
Appropriate Model	Three-stage	Two-stage	Gordon growth

This pattern is not predestined because many firms are successful in constantly adapting and entering into new growth opportunities. Mature firms may develop technology that forms the basis for a whole new product and market. The point is that a multistage model is required in order to value many firms. Fortunately, the GGM is easily adaptable to multistage growth.

LOS 20.l: Explain the assumptions and justify the selection of the two-stage DDM, the H-model, the three-stage DDM, or spreadsheet modeling to value a company's common shares.

For most companies, the Gordon growth model assumption of constant dividend growth that continues into perpetuity is unrealistic. For example, many companies experience growth rates in excess of the required rate of return for short periods of time as a result of a competitive advantage they have developed. We need more realistic multistage growth models to estimate value for companies with several stages of future growth. The appropriate model is the one that most closely matches the firm's expected pattern of growth. However, whichever multistage model we use, there are two important points to keep in mind:

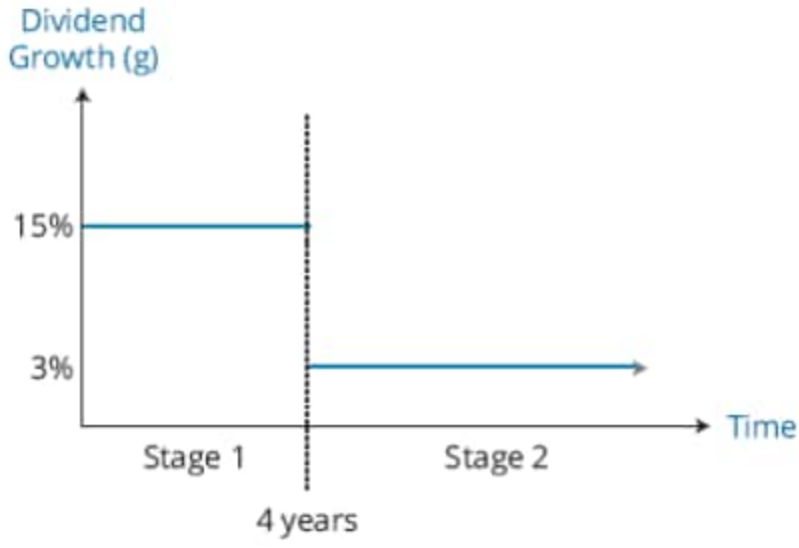
- We're still just forecasting dividends into the future and discounting them back to today to find intrinsic value.
- Over the long term, growth rates tend to revert to a long-run rate approximately equal to the long-term growth rate in real gross domestic product (GDP) plus the long-term inflation rate. Historically, that number has been between 2% and 5%. Anything higher than 5% as a long-run perpetual growth rate is difficult to justify.

PROFESSOR'S NOTE

The required rate of return applicable to each stage might also be different. For instance, a firm with a supernormal growth rate is probably more risky (should have a higher required return) than a stable, mature firm with a slower growth rate. In most cases on the exam, however, a single required return is applied to all of the stages.

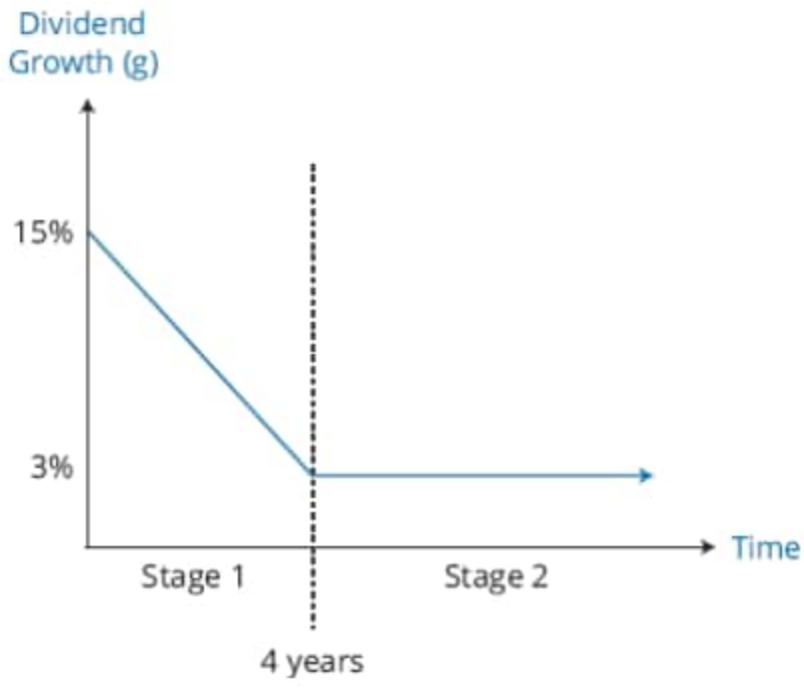
Two-Stage DDM: The most basic multistage model is a two-stage DDM in which we assume the company grows at a high rate for a relatively short period of time (the first stage) and then reverts to a long-run perpetual growth rate (the second stage). The length of the high-growth phase is a function of the visibility of the company's operations; in other words, it tells how far into the future the analyst can predict growth rates with a certain degree of confidence. An example in which the two-stage model would apply is a situation in which a company has a patent that will expire. For example, suppose a firm is expected to grow at 15% until patents expire in four years, then immediately revert to a long-run growth rate of 3% in perpetuity. This stock should be modeled by a two-stage model, with dividends growing at 15% before the patent expires and 3% thereafter (see Figure 20.2).

Figure 20.2: Example of a Two-Stage DDM



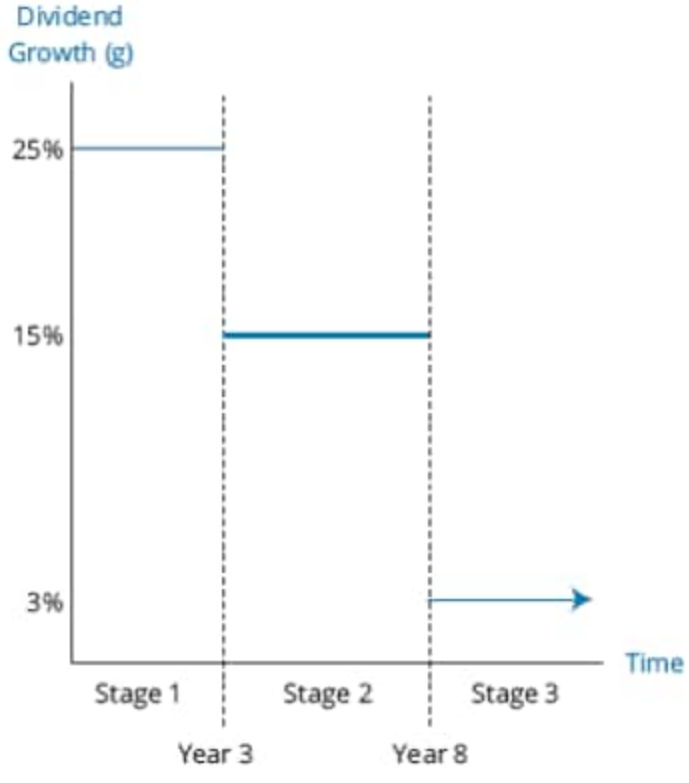
H-Model: The problem with the basic two-stage DDM is that it is usually unrealistic to assume that a stock will experience high growth for a short period, then *immediately* fall back to a long-run level. The H-model utilizes a more realistic assumption: the growth rate starts out high and then declines linearly over the high-growth stage until it reaches the long-run average growth rate. For example, consider a firm that generates high profit margins, faces little competition from within its industry, and is currently growing at 15%. We might forecast that the firm's growth rate will decline by 3% per year as competitors enter the market until it reaches 3% at the end of the fourth year, when the industry matures and growth rates stabilize (see Figure 20.3).

Figure 20.3: Example of an H-Model



Three-stage DDM: Three-stage models are appropriate for firms that are expected to have three distinct stages of earnings growth. A three-stage model is a slightly more complex refinement of a two-stage model. For example, suppose we forecast that a biotech company will experience supernormal growth of 25% for three years, then 15% growth for five years, and finally slow down to a stable, long-run rate of 3% (see Figure 20.4). Alternatively, in Stage 2, the growth rate may also linearly decay to the Stage 3 stable, long-run growth rate.

Figure 20.4: Example of a Three-Stage DDM



Spreadsheet modeling: The two- and three-stage models we've discussed so far are really just models in which we've simplified the growth pattern to make the calculations doable. Obviously that's an important consideration on the exam.

However, in practice we can use spreadsheets to model any pattern of dividend growth we'd like with different growth rates for each year because the spreadsheet does all the calculations for us. Spreadsheet modeling is applicable to firms about which you have a great deal of information and can project different growth rates for differing periods, such as construction firms and defense contractors with many long-term contracts. Figure 20.5 is an example of three different spreadsheet models.

Figure 20.5: Examples of Spreadsheet Modeling

	Growth Rates						
Year	1	2	3	4	5	6	7 and after
Scenario 1	20%	19%	13%	5%	5%	5%	5%
Scenario 2	20%	19%	13%	11%	5%	5%	5%
Scenario 3	20%	19%	13%	11%	8%	7%	5%

LOS 20.m: Describe terminal value and explain alternative approaches to determining the terminal value in a DDM.

No matter which dividend discount model we use, we have to estimate a terminal value at some point in the future. There are two ways to do this: using the Gordon growth model and using the market multiple approach.

The most common method (on the exam) is to estimate the **terminal value** with the Gordon growth model. In other words, at some point in the future, we assume dividends will begin to grow at a constant, long-term rate. Then the terminal value at that point is just the value derived from the Gordon growth model.

Many analysts also use market price multiples to estimate the terminal value rather than use the GGM method of discounting dividends. For example, we could forecast earnings and a P/E ratio at the forecast horizon and then estimate the terminal value as the P/E multiplied by the earnings estimate.

EXAMPLE: Estimating terminal value

Level Partners is expected to have earnings in ten years of $12 per share, a dividend payout ratio of 50%, and a required return of 11%. At that time, the dividend growth rate is expected to fall to 4% in perpetuity, and the trailing P/E ratio is forecasted to be eight times earnings. Estimate the terminal value at the end of ten years using the Gordon growth model and the P/E multiple.

Answer:

The dividend at the end of ten years is expected to be $6 ($12 multiplied by 50%). The dividend in Year 11 is then $6.00 × 1.04 = $6.24. The terminal value using the Gordon growth model is therefore:

$$\text{terminal value in Year 10} = \frac{D_{10} \times (1+g)}{r-g} = \frac{D_{11}}{r-g}$$

$$= \frac{\$6.24}{0.11 - 0.04} = \$89.14$$

The terminal value given forecasted earnings of $12 and a P/E ratio of 8 is:

terminal value in Year 10 (trailing P/E multiple) = $12.00 × 8 = $96.00

LOS 20.n: Calculate and interpret the value of common shares using the two-stage DDM, the H-model, and the three-stage DDM.

Valuation Using the Two-Stage Model

The **two-stage fixed growth rate model** is based on the assumption that the firm will enjoy an initial period of high growth, followed by a mature or stable period in which growth will be lower but sustainable:

$$V_0 = \left[\sum_{t=1}^{n} \frac{D_0(1+g_S)^t}{(1+r)^t}\right] + \left[\frac{D_0 \times (1+g_S)^n \times (1+g_L)}{(1+r)^n \times (r-g_L)}\right]$$

where:
g_S = short-term growth rate
g_L = long-term growth rate
r = required return
n = length of high growth period

EXAMPLE: Calculating value with a two-stage DDM

Sea Island Recreation currently pays a dividend of $1.00. An analyst forecasts growth of 10% for the next three years, followed by 4% growth in perpetuity thereafter. The required return is 12%. Calculate the current value per share.

Answer:

We could solve the problem by plugging the appropriate numbers into the formula as follows:

$$V_0 = \left[\sum_{t=1}^{3} \frac{\$1.00 \times (1.10)^t}{(1.12)^t}\right] + \left[\frac{\$1.00 \times (1.10)^3 \times (1.04)}{(1.12)^3(0.12 - 0.04)}\right]$$

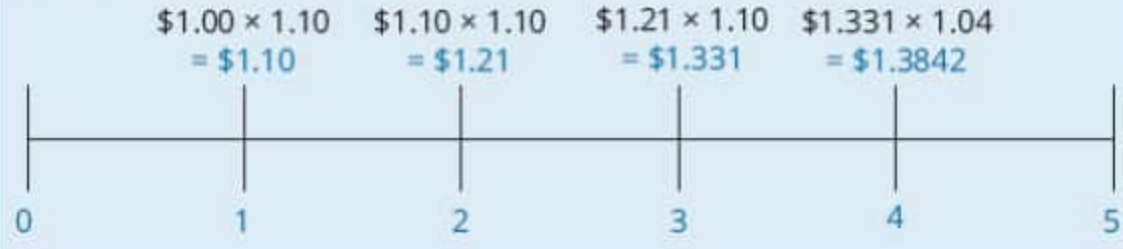
$$V_0 = \frac{\$1.00 \times (1.10)^1}{(1.12)^1} + \frac{\$1.00 \times (1.10)^2}{(1.12)^2} + \frac{\$1.00 \times (1.10)^3}{(1.12)^3} + \frac{\$1.00 \times (1.10)^3 \times (1.04)}{(1.12)^3 \times (0.12 - 0.04)}$$

$$V_0 = \frac{\$1.10}{(1.12)^1} + \frac{\$1.21}{(1.12)^2} + \frac{\$1.331}{(1.12)^3} + \frac{\$1.3842}{(1.12)^3 \times (0.12 - 0.04)}$$

$$V_0 = \$15.21$$

If we were robots instead of humans, this would be fine. However, because we are human beings (and not mindless machines), it might be better to actually try to understand what we are doing, limit the need to remember yet another formula, and reduce the possibility of error. This can be accomplished by drawing a time line and placing the appropriate cash flows on the line, followed by the fairly straightforward computation on our financial calculators that we did earlier (in the multiperiod DDM). The forecasted dividends are shown in the following figure.

Dividend Cash Flows

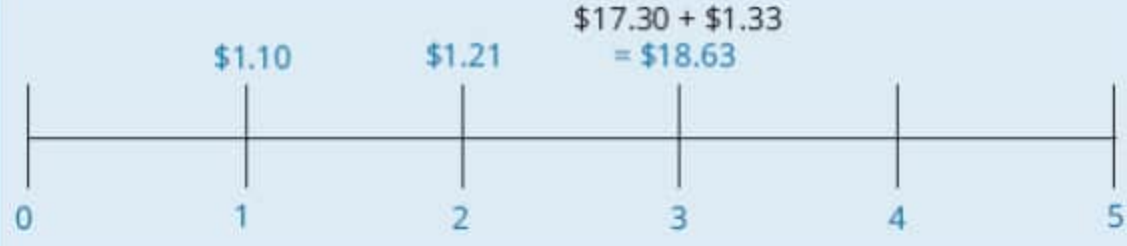


Constant growth at 4% begins after the third year, and we can employ the DDM to determine the value of the stock at time t = 3. Accordingly:

$$V_3 = \frac{D_3 \times (1 + g)}{r - g} = \frac{D_4}{r - g} = \frac{\$1.3842}{0.12 - 0.04} = \$17.30$$

Now the problem is exactly like the three-period DDM we solved in an earlier LOS: we know the dividends in Years 1, 2, and 3, the terminal value in Year 3, and the discount rate. The cash flows that we need to solve the problem are shown in the following figure.

Dividend and Terminal Value Cash Flows



The financial calculator does the hard work for us: CF0 = 0; C01 = 1.10; C02 = 1.21; C03 = 18.63; I = 12; CPT → NPV = 15.21.

We arrived at an estimated value of $15.21 using the calculator, which is exactly the same answer we got with the ugly formula. After a bit of practice, you should find that the calculator method is easier than the complicated formula, and, just as importantly, it will be less prone to error.

The value of a firm that doesn't currently pay a dividend is a simple version of the two-stage DDM, where the firm pays no dividends in the first stage. Therefore, the value of the firm is just the present value of the terminal value computed at the point in time at which dividends are projected to start.

EXAMPLE: Valuing a non-dividend-paying stock

Arena Distributors is a new company and currently pays no dividends. The company recently reported earnings of $1.50 per share and is expected to grow at a 15% rate for the next four years. Beginning in Year 5, Arena is expected to distribute 20% of its earnings in the form of dividends and to have a constant growth rate of 5%. The required rate of return is 12%. Calculate the value of Arena shares today.

Answer:

First forecast the earnings in Year 5. Then calculate the dividends in Year 5 as 20% of Year 5 earnings. Applying the Gordon growth model to the Year 5 dividend gives us an estimate of the terminal value in Year 4. The terminal value discounted back four years is the current value of the stock.

$$E_4 = \$1.50 \times (1.15)^4 = \$2.62$$

$$E_5 = \$2.62 \times 1.05 = \$2.75$$

$$D_5 = \$2.75 \times 0.20 = \$0.55$$

$$V_4 = \frac{\$0.55}{0.12 - 0.05} = \$7.86$$

$$V_0 = \frac{\$7.86}{1.12^4} = \$5.00$$

Valuation Using the H-Model

The earnings growth of most firms does not abruptly change from a high rate to a low rate as in the two-stage model but tends to decline over time as competitive forces come into play. The H-model approximates the value of a firm assuming that an initially high rate of growth declines linearly over a specified period. The formula for this approximation is:

$$V_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0 \times H \times (g_S - g_L)}{r-g_L}$$

where:

$H = \left(\frac{t}{2}\right)$ = half-life (in years) of high-growth period

t = length of high growth period

g_S = short-term growth rate

g_L = long-term growth rate

r = required return

Note that the first term is what the shares would be worth if there were no high-growth period and the perpetual growth rate was g_L. The second term is an approximation of the additional value that results from the high-growth period.

EXAMPLE: Calculating value with the H-model

Omega Foods currently pays a dividend of €2.00. The growth rate, which is currently 20%, is expected to decline linearly over the next ten years to a stable rate of 5% thereafter. The required return is 12%. Calculate the current value of Omega.

Answer:

$$V_0 = \frac{€2.00 \times 1.05}{0.12 - 0.05} + \frac{€2.00 \times \left(\frac{10}{2}\right) \times (0.20 - 0.05)}{0.12 - 0.05}$$

$$= €30.00 + €21.43 = €51.43$$

Remember that the H-model provides only an approximation of the value of Omega shares. To find the exact answer, we'd have to forecast each of the first ten dividends, applying a different growth rate to each, and then discount them back to the present at 12%. In general, the H-value approximation is more accurate the shorter the high-growth period, *t*, and/or the smaller the spread between the short-term and long-term growth rates, $g_S - g_L$.

Valuation Using the Three-Stage DDM

A *three-stage model* can be used to estimate the value of a firm that is projected to have three stages of growth with a fixed rate of growth for each stage. The approach is the same as the two-stage model, with the projected dividends and the terminal value of the shares discounted to their present value at the required rate of return. Again, a time line or an equivalent cash flow table will help the intuition. Your speed and accuracy will develop with practice.

EXAMPLE: Calculating value with the three-stage DDM

R&M has a current dividend of $1.00 and a required rate of return of 12%. A dividend growth rate of 15% is projected for the next two years, followed by a 10% growth rate for the next four years before settling down to a constant 4% growth rate thereafter. Calculate the current value of R&M.

Answer:

Relevant Cash Flows for R&M Example

Time	Value	Calculation	D_t or V_t
1	D_1	\$1.00(1.15)	\$1.150
2	D_2	\$1.150(1.15)	\$1.323
3	D_3	\$1.323(1.10)	\$1.455
4	D_4	\$1.455(1.10)	\$1.600
5	D_5	\$1.600(1.10)	\$1.760
6	D_6	\$1.760(1.10)	\$1.936
6	V_6	[\$1.936(1.04)] / (0.12 − 0.04)	\$25.168

Now we enter the cash flows into our calculator, noting that the total cash flow at Time 6 is \$1.936 + \$25.168 = \$27.104: CF0 = 0; C01 = 1.150; C02 = 1.323; C03 = 1.455; C04 = 1.600; C05 = 1.760; C06 = 27.104; I = 12; CPT → NPV = 18.864.

According to the three-stage model, R&M is worth \$18.864 today. This question is tedious, but it is not a question to be feared, as long as your calculator batteries hold up.

EXAMPLE: Three-stage growth model with linear growth decline in Stage 2

As an analyst, you have gathered the following information on a company you are tracking. The current annual dividend is \$0.75. Dividends are expected to grow at a rate of 12% over the next three years, decline linearly to 4% over the next six years, and then remain at a long-term equilibrium growth rate of 4% in perpetuity. The required return is 9%. Calculate the value of the company.

Answer:

Let's start by valuing the last two stages using the H-model. We know that:

$$V_3 = \frac{[D_3 \times (1 + g_L)] + [D_3 \times H(g_S - g_L)]}{r - g_L}$$

$$D_3 = D_0(1 + g_S)^3 = \$0.75(1.12)^3 = \$1.0537$$

It follows that:

$$V_3 = \frac{[\$1.0537 \times (1.04)] + \left[\$1.0537 \times \frac{6}{2} \times (0.12 - 0.04)\right]}{0.09 - 0.04} = \$26.9747$$

Now we have a series of three cash flows to discount in order to find the current value of the stock, and our financial calculator does the rest of the work.

CF0 = 0; C01 = D_1 = \$0.75(1.12) = \$0.84; C02 = D_2= \$0.75(1.12)^2 = \$0.9408; and C03 = D_3 + V_3 = \$1.0537 + \$26.9747 = \$28.0284; I = 9; CPT → NPV = 23.2056.

The price of the stock is \$23.2056.

Valuation Models Using Spreadsheets

If you have been calculating along with the examples, you already recognize that the use of these models can be computationally intensive, though the formulas are straightforward. These characteristics make DDM models ideally suited to being solved with spreadsheet software. A spreadsheet allows the analyst to easily calculate values based on models with many stages, growth rates, and required rates of return.

LOS 20.o: Explain the use of spreadsheet modeling to forecast dividends and to value common shares.

We have previously noted that, in practice, financial analysts are much more likely to use a spreadsheet than any of the stylized models presented here when valuing equity securities. The reason for this is the inherent flexibility and computational accuracy of spreadsheet modeling.

A firm's dividends (or cash flows) often do not grow at a smooth rate for an extended period. When changes in dividends can be predicted, there can obviously be more than two or three stages of change involved. Moreover, there are often idiosyncratic events that, even if they can be predicted, do not fit neatly into any of the patterns required by these models. Using a spreadsheet is relatively straightforward and can accommodate nearly any pattern that the analyst can imagine.

Step 1: Establish the base level of cash flows or dividends. In the case of dividends, this would ordinarily be either the amount paid over the preceding year or some normalized level based upon projected firm earnings.

Step 2: Estimate changes in the firm's dividends for the foreseeable future (also known as the supernormal growth period) and project future cash dividends on the basis of these estimates. Because the spreadsheet can be programmed in a virtually infinite series of combinations, any dividend pattern desired can be achieved.

Step 3: Because an equity security has an infinite life, the analyst needs to estimate what normalized level of growth will occur at the end of the supernormal growth period. This allows for an estimate of a terminal value, representing the cash flow (i.e., the firm's value if sold at this time) to be received at the end of the supernormal growth period.

Step 4: Discount all projected dividends and the terminal value back to today to obtain an estimate of the firm's current value.

The last step is where the use of the spreadsheet really pays off. The analyst is in position to conduct detailed scenario analyses wherein the model inputs can be altered to see how changes in the pattern of future dividends, interest rates, and firm risk affect firm valuation estimates.

The bottom line is that performing the analysis just listed for a period of 10 or 20 years is relatively easy with a spreadsheet but would be all but impossible with any of the stylized models presented.

LOS 20.i: Estimate a required return based on any DDM, including the Gordon growth model and the H-model.

We have been using DDMs to determine the value of a stock, assuming that we know the dividends and required rates of return. The models are just as useful in determining the required rate of return, given the current value and dividends of a stock. No matter which model you're using (whether it's a two-stage DDM, an H-model, a three-stage DDM, or a spreadsheet model), in theory this is easy: *Given all the other inputs to the model, we can back into the expected return that makes the present value of the forecasted dividend stream equal to the current market price.*

For example, if the dividend growth rate is constant forever, we can use the Gordon growth model to calculate the implied expected return given the expected dividend, the current market price, and the expected growth rate:

$$r = \frac{D_1}{P_0} + g$$

EXAMPLE: Calculating expected return with the Gordon growth model

Smyth & Weston Explosives' stock is expected to pay a dividend of $1.60, has a current price of $40.00, and has a projected growth rate of 9%. Calculate S&W's implied required return.

Answer:

$$r = \frac{\$1.60}{\$40.00} + 0.09 = 0.13 = 13\%$$

The H-model can be rewritten in terms of *r* and used to solve for *r* given the other model inputs:

$$r = \left[\left(\frac{D_0}{P_0}\right) \times \left\{(1 + g_L) + \left[H \times (g_S - g_L)\right]\right\}\right] + g_L$$

EXAMPLE: Solving for expected return with the H-model

Beluga Fisheries, Inc., just paid a current dividend of $0.75, which has been growing at a rate of 10%. This growth rate is expected to decline to 5% over the next five years and then remain at 5% indefinitely. Calculate the implied required return for Beluga based on the current price of $30.00.

Answer:

$$r = \left(\frac{\$0.75}{\$30.00}\right) \times \left\{(1 + 0.05) + \left[\left(\frac{5}{2}\right) \times (0.10 - 0.05)\right]\right\} + 0.05 = 0.0794 = 7.94\%$$

Using the general two-stage model is more difficult because we have to solve for *r* with an iterative process because there is no closed-form solution. Here is an example of how to approach the problem using the two-stage DDM.

EXAMPLE: Solving for expected return with the two-stage DDM

Ozone Laboratories, Inc., recently paid a dividend of $1.00. Dividends are expected to grow at a rate of 11% for the next two years and 8% thereafter. The implied required return for Ozone based on the current price of $35.60 is *closest* to:

A. 9.5%.

B. 10.0%.

C. 11.2%.

Answer:

We have to solve for r in the following equation:

$$\frac{\$1.00 \times 1.11}{1+r} + \frac{\$1.00 \times 1.11^2}{(1+r)^2} + \left(\frac{\$1.00 \times 1.11^2 \times 1.08}{r - 0.08}\right)\left(\frac{1}{(1+r)^2}\right)$$

$$= \$35.60$$

This actually requires an iterative process. The easiest way to do this is to start with the middle value from the three answer choices (10%, in this case):

terminal value in Year 2 estimate

$$= \$34.00 = \frac{D_3}{0.10 - 0.08} = \frac{(\$1.00) \times (1.11)^2 \times (1.08)}{0.10 - 0.08}$$

$$= \frac{\$1.331}{0.10 - 0.08} = 66.55$$

Use your calculator to value the stock:

CF0 = 0, C01 = 1.11, C02 = 1.23 + 66.55 = 67.78

NPV (I = 10%) = $57.03 (too high relative to the given market price of $35.60)

Hence, the discount rate has to be higher. The only higher value (from the multiple choices) is 11.2%.

Let's confirm:

$P_2 = 1.331 / (0.112 - 0.08) = 41.59$

CF0 = 0, C01 = 1.11, C02 = 1.23 + 41.59 = 42.82

PV (I = 11.20%) = $35.63 (close enough)

LOS 20.p: Calculate and interpret the sustainable growth rate of a company and demonstrate the use of DuPont analysis to estimate a company's sustainable growth rate.

The **sustainable growth rate (SGR)** is the rate at which earnings (and dividends) can continue to grow indefinitely, assuming that the firm's debt-to-equity ratio is unchanged and it doesn't issue new equity. SGR is a simple function of the earnings retention ratio and the return on equity:

$$SGR = b \times ROE$$

where:
b = earnings retention rate = 1 − dividend payout rate
ROE = return on equity

The SGR is important because it tells us how quickly a firm can grow with internally generated funds.

EXAMPLE: Calculating SGR

Biotechnica, Inc., is growing earnings at an annual rate of 9%. It currently pays out dividends equal to 20% of earnings. Biotechnica's ROE is 15%. Calculate its SGR.

Answer:

$$g = (1 - 0.20) \times (15\%) = 12\%$$

A firm's rate of growth is a function of both its earnings retention and its return on equity. ROE can be estimated with the DuPont formula, which presents the relationship between margin, sales, and leverage as determinants of ROE:

$$ROE = \frac{\text{net income}}{\text{stockholders' equity}} = \left(\frac{\text{net income}}{\text{sales}}\right) \times \left(\frac{\text{sales}}{\text{total assets}}\right) \times \left(\frac{\text{total assets}}{\text{stockholders' equity}}\right)$$

If the other factors remain constant, we can see that the growth of a firm's earnings (and dividends) is a function of its ROE and its retention rate:

$$g = \left(\frac{\text{net income} - \text{dividends}}{\text{net income}}\right) \times \left(\frac{\text{net income}}{\text{sales}}\right) \times \left(\frac{\text{sales}}{\text{total assets}}\right) \times \left(\frac{\text{total assets}}{\text{stockholders' equity}}\right)$$

This has also been called the *PRAT* model, where SGR is a function of the profit margin (P), the retention rate (R), the asset turnover (A), and financial leverage (T). Two of these factors are functions of the firm's financing decisions (leverage and earnings retention), and two are functions of performance (return on assets equals profit margin multiplied by asset turnover). These factors can be used as building blocks in developing an estimate of a firm's growth. If the actual growth rate is forecasted to be greater than SGR, the firm will have to issue equity unless the firm increases its retention ratio, profit margin, total asset turnover, or leverage.

PROFESSOR'S NOTE

For the Equity Valuation portion of the curriculum, we use *beginning-of-year* balance sheet values for mixed ratios (e.g., total asset turnover) unless otherwise specified in the question.

EXAMPLE: Calculating ROE and SGR

Halo Construction has been successful in a mature industry. Over the last three years, Halo has averaged a profit margin of 10%, a total asset turnover of 1.8, and a leverage ratio of 1.25. Assuming Halo continues to distribute 40% of its earnings as dividends, calculate its long-term SGR.

Answer:

$$g = P \times R \times A \times T$$

$g = 0.10 \times (1 - 0.4) \times 1.8 \times 1.25 = 0.135 = 13.5\%$

EXAMPLE: Calculating ROE and SGR

Given the following partial balance sheets and income statement for Far Horizons Company, calculate three components of the ROE (using the DuPont model) and the sustainable growth rate for 2023 based on beginning balance sheet values. Use a dividend payout ratio of 30%. All values are in millions of USD.

Far Horizons Income Statement

Income statement for fiscal year 2023	
Sales	$40.0
Net income	$1.8

Far Horizons Balance Sheet

Balance sheet fiscal year end 2022 and 2023

	2022	2023		2022	2023
Assets	$30.0	$50.0	Liabilities	$10.0	$20.0
			Equity	20.0	30.0
Total	$30.0	$50.0	Total	$30.0	$50.0

Answer:

$$\text{profit margin} = \frac{\$1.80}{\$40.00} = 0.045 = 4.5\%$$

$$\text{asset turnover} = \frac{\$40.00}{\$30.00} = 1.333$$

$$\text{financial leverage} = \frac{\$30.00}{\$20.00} = 1.5$$

$$\text{ROE} = (0.045) \times (1.333) \times (1.5) = 0.09 = 9.0\%$$

$$g = \text{ROE} \times b = 9.0\% \times (1 - 0.30) = 6.3\%$$

LOS 20.j: Evaluate whether a stock is overvalued, fairly valued, or undervalued by the market based on a DDM estimate of value.

If a stock is trading at a price (market price) higher than the price implied by a dividend discount model (model price), the stock is considered to be **overvalued**. Similarly, if the market price is lower than the model price, the stock is considered to be **undervalued**, and if the model price is equal to the market price, the stock is considered to be **fairly valued**.

PROFESSOR'S NOTE

Overpriced means overpriced in the market.

In other words: market price > calculated value.

MODULE QUIZ 20.3

1. Aerosail Company exhibits the following fundamental characteristics:
   - Profit margins are higher than the industry average but have fallen over the last four years from 45% to 32%.
   - Free cash flow to equity is positive and has grown 18% in the last two years.
   - Dividend payout has increased from 5% to 15% in the last three years.

   Which phase of the life cycle is Aerosail most likely in, and which dividend discount model is *most appropriate* to value the company's common stock?

	Phase	Model
A.	Growth	H-model
B.	Transition	Multistage
C.	Mature	Gordon growth

2. An analyst forecasts dividends over the next three years for Aerosail Company of $1.00, $2.00, and $2.50. He forecasts a terminal value in three years of $52.00. Aerosail is currently selling for $39.71. The implied required return based on the analyst forecast is *closest* to:
   A. 10.2%.
   B. 13.5%.
   C. 14.8%.

Use the following information to answer Questions 3 through 7.

Jamie Johnson, CFA, has been asked by her supervisor to evaluate the value of two stocks in the recreational vehicle industry, AAA Motorhomes (AAA) and Three Star Travelers (TST). Johnson compiled analyst information for the two companies in Table 1. The expected return on the market is 11%, and the risk-free rate is 4%. Johnson's supervisor has requested that Johnson focus on dividends in estimating the value of the two firms.

TABLE 1	AAA	TST
Current Roe	0.30	0.22
Current EPS	$2.50	$4.60
Retention Ratio	0.40	0.30
Beta	1.2	0.9

TABLE 2	Risk Premiums	Factor Sensitivities	
		AAA	TST
Confidence Risk	0.048	0.63	0.42
Time Horizon Risk	0.031	0.47	0.39
Inflation Risk	0.045	0.70	0.51
Business Cycle Risk	0.038	0.98	0.91
Market Timing Risk	–0.018	0.05	0.21

3. The sustainable growth rates for each firm are *closest* to:

	AAA	TST
A.	18.0%	6.6%
B.	12.0%	6.6%
C.	12.0%	15.4%

4. Johnson decides to start by estimating the value of the two stocks using the constant growth dividend discount model and estimating the required rate of returns using the capital asset pricing model (CAPM). Both firms are expected to grow at their sustainable growth rates. The estimated values are *closest* to:

	AAA	TST
A.	$273.54	$92.77
B.	$273.54	$48.57
C.	$420.00	$92.77

5. Johnson believes the estimate for TST using the constant dividend discount model (DDM) is appropriate. However, she believes that AAA is expected to grow at a higher rate of 20% for the next four years and then grow at a rate of 7% after that. Using the two-stage model, and CAPM for the required rate of return, the current value of AAA is *closest* to:
   A. $45.69.
   B. $58.00.
   C. $61.62.

6. After further consideration, Johnson feels the growth rates of AAA and TST are more likely to gradually decline over the next four years and therefore considers the H-model. She estimates TST growth will decline from current 15% to long-term 5% and AAA growth will decline from current 20% to long-term 7%. Johnson estimates the required rate of return for AAA and TST to be 15.3% and 12.6%, respectively. Johnson's estimated values of AAA and TST using the H-model are *closest* to:

	AAA	TST
A.	$15.35	$52.96
B.	$24.04	$35.58
C.	$24.04	$52.96

7. Johnson's supervisor also requested a calculation of the justified leading P/E ratios for the two firms using a macroeconomic multifactor model based on the information in Table 2 (on the previous page) to estimate the required returns. Assuming that the earnings and dividends will grow at 5% for TST and 7% for AAA, the justified leading P/E ratios are *closest* to:

	AAA	TST
A.	11.11	12.87
B.	7.26	9.21
C.	11.89	13.21

Use the following information to answer Questions 8 and 9.

Sally Curten, CFA, has gathered the following information on Jameston Fiber Optics, Inc., (JFOI) and industry norms.

Selected Financial Data for JFOI (in millions)

Total sales:	$2,044	(fiscal year 2023)
Total assets:	$1,875	(FYE 2022)
Net income:	$322	(fiscal year 2023)
Total debt:	$1,465	(FYE 2022)

Industry ratios:	Net profit margin	= 15.7%
	Total asset turnover	= 1.1
	Return on equity	= 40.5%

8. The return on equity for JFOI is *closest* to:
   A. 17.2%.
   B. 37.4%.
   C. 78.5%.

9. Using DuPont analysis, Curten determines that the *most influential* factor(s) that management used to increase the ROE for JFOI compared to the industry is:
   A. asset efficiency.
   B. profitability.
   C. leverage.

Use the following information to answer Questions 10 and 11.

Lisa Design pays a current annual dividend of €2.00 and is currently growing at a rate of 20%. This rate is expected to decline to 10% over four years and remain at that level indefinitely. The required rate of return for an investment in Lisa Design is 18%.

10. The current estimated value of Lisa Design using the H-model is *closest* to:
    A. €24.22.
    B. €29.78.
    C. €32.50.

11. Suppose instead that the 20% growth rate is expected to persist for four years and then decline immediately to 10%, at which level it will remain indefinitely. The current estimated value of Lisa Design is *closest* to:
    A. €31.99.
    B. €32.50.
    C. €37.76.

12. Jill Smart is an analyst with Allenton Partners. Jill is reviewing the valuation of three companies (P, Q, and R) using the dividend discount model (DDM) and their corresponding current market prices.

    The information below summarizes the findings:

	Stock		
	P	Q	R
Market price	35	40	38
DDM price	40	35	38

Based on the above information, which statement best describes the market's valuation of P, Q, and R?

A. P is overvalued, Q is undervalued, and R is fairly valued.
B. P is undervalued, Q is fairly valued, and R is overvalued.
C. P is undervalued, Q is overvalued, and R is fairly valued.

13. Viking Insurance forecasts earnings next year of $4.50 per share. Viking has a dividend payout ratio of 40%. The required return is 15%. Return on equity is 8.33%. The present value of growth opportunities and the value of the stock based on the Gordon growth model are *closest* to:

	PVGO	Share value
A.	$4.00	$34.00
B.	–$21.00	$9.00
C.	–$12.00	$18.00

KEY CONCEPTS

LOS 20.a

In stock valuation models, there are three predominant definitions of future cash flows: dividends, free cash flow, and residual income.

Dividends are appropriate when:

- The company has a history of dividend payments.
- The dividend policy is clear and related to the earnings of the firm.
- The asset is being valued from the position of a minority shareholder.

Free cash flow is appropriate when:

- The company does not have a dividend payment history or has a dividend payment history that is not related to earnings.
- The free cash flow corresponds with the firm's profitability.
- The asset is being valued from the position of a controlling shareholder.

Residual income is most appropriate for firms that:

- Do not have dividend payment histories.
- Have negative free cash flow for the foreseeable future.
- Have transparent financial reporting and high-quality earnings.

LOS 20.b

Stock valuation can be approached using DDMs for single periods, two periods, and multiple holding periods. No matter what the holding period, the stock price is the present value of the forecasted dividends plus the present value of the estimated terminal value, discounted at the required return.

LOS 20.c

The Gordon growth model assumes that:

- Dividends grow at a constant growth rate.
- Dividend policy is related to earnings.
- Required rate of return r is greater than the long-term constant growth rate g.

$$V_0 = \frac{D_0 \times (1+g)}{r-g} = \frac{D_1}{r-g}$$

LOS 20.d

The value of a fixed-rate perpetual preferred stock is equal to the dividend divided by the required return:

$$\text{value of perpetual preferred shares} = \frac{D_p}{r_p}$$

LOS 20.e

The GGM has a number of characteristics that make it useful and appropriate for many applications:

- Very applicable to stable, mature dividend-paying firms.
- Can be applied to indices very easily.
- Easily communicated and explained because of its straightforward approach.
- Useful in determining price-implied growth rates, required rates of return, and value of growth opportunities.
- Can be added to other more complex valuations.

There are also some characteristics that limit the applications of the Gordon model:

- Valuations are very sensitive to estimates of growth rates and required rates of return, both of which are difficult to estimate with precision.
- The model cannot be easily applied to non-dividend-paying stocks.
- Unpredictable growth patterns of some firms would make using the model difficult.

LOS 20.f

If P_0 is fairly priced:

$$P_0 = V_0 = D_1 / (r - g)$$

$$g = r - (D_1 / P_0)$$

LOS 20.g

The value of an asset is equal to the current earnings stream divided by the required return, plus the present value of growth opportunities (PVGO):

$$\text{value} = \frac{\text{earnings}}{\text{required return}} + \text{PVGO}$$

LOS 20.h

The Gordon growth model can also be used to estimate justified leading and trailing P/E ratios based on the fundamentals of the firm:

$$\text{justified leading P/E} = \frac{P_0}{E_1} = \frac{1 - b}{r - g}$$

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{(1 - b) \times (1 + g)}{r - g}$$

LOS 20.i

Given all of the other inputs to the Gordon growth model or H-model, we can rearrange the formula to back into the expected return that makes the present value

of the forecasted dividend stream equal to the current market price:

GGM:

$$r = \frac{D_1}{P_0} + g$$

H-Model:

$$r = \left[\left(\frac{D_0}{P_0}\right) \times \{(1 + g_L) + [H \times (g_S - g_L)]\}\right] + g_L$$

LOS 20.j

If the model price is lower than (higher than, equal to) the market price, the stock is considered overvalued (undervalued, fairly valued).

LOS 20.k

Most firms go through a pattern of growth that includes three stages:

- An initial growth stage, where the firm has rapidly increasing earnings, little or no dividends, and heavy reinvestment.
- A transition stage, in which earnings and dividends are still increasing but at a slower rate as competitive forces reduce profit opportunities and the need for reinvestment.
- A mature stage, in which earnings grow at a stable but slower rate, and payout ratios are stabilizing as reinvestment matches depreciation and asset maintenance requirements.

LOS 20.l, 20.n

Multistage growth models have a number of strengths and a few limitations.

Strengths:

- Multiple-stage DDMs are flexible.
- The models can be used to estimate values given assumptions of growth and required return or to derive required returns and projected growth rates implied by market prices.
- The models enable the analyst to review all of the assumptions built into the models and to consider the impact of different assumptions.
- The models are very easily constructed and computed with the use of spreadsheet software.

Limitations:

- The estimates are only as good as the assumptions and projections used as inputs.
- A model must be fully understood in order for the analyst to arrive at accurate estimates. Without a clear understanding of the model, the effects of assumptions cannot be determined.
- The estimates of value are very sensitive to the assumptions of growth and required return.
- Formulas and data input can lead to errors that are difficult to identify.

There are several multistage growth models, with the most appropriate being the one that most closely matches the firm's actual growth pattern. The terminal value for multistage models is estimated using the Gordon growth model or market price multiples.

- The two-stage model has two distinct stages with a stable rate of growth during each stage.
- The H-model also has two stages but assumes that the growth rate declines at a constant linear rate during the first stage and is stable in the second stage:

$$V_0 = \frac{D_0 \times (1 + g_L)}{r - g_L} + \frac{D_0 \times H \times (g_S - g_L)}{r - g_L}$$

- The three-stage model can either have stable growth rates in each of the three stages or have a linearly declining rate in the second stage.
- The spreadsheet model can incorporate any number of stages with specified rates of growth for each stage. This is most easily modeled with a computer spreadsheet.

LOS 20.m

No matter which dividend discount model we use, we have to estimate a terminal value using either the Gordon growth model or the market multiple approach. The Gordon growth model assumes that in the future, dividends will begin to grow at a constant, long-term rate. Then the terminal value at that point is just the value derived from the Gordon growth model.

Using market price multiples to estimate the terminal value involves, for example, forecasting earnings and a P/E ratio at the forecast horizon and then estimating the terminal value as the P/E multiplied by the earnings estimate.

LOS 20.o

In practice, financial analysts are much more likely to use a spreadsheet than any of the stylized models present here when valuing equity securities. The reason for this is the inherent flexibility and computational accuracy of spreadsheet modeling. Steps include:

- Establish the base level of cash flows or dividends.
- Estimate changes in the firm's dividends for the foreseeable future.
- Estimate what normalized level of growth will occur at the end of the supernormal growth period, allowing for an estimate of a terminal value.
- Discount and sum all projected dividends and the terminal value back to today.

LOS 20.p

The SGR is defined as the rate that earnings (and dividends) can continue to grow indefinitely, assuming that a firm's debt-to-equity ratio is unchanged and it doesn't issue any new equity. It can be derived from the relationship between the firm's retention rate and ROE as determined by the DuPont formula:

$$g = \left(\frac{\text{net income} - \text{dividends}}{\text{net income}}\right) \times \left(\frac{\text{net income}}{\text{sales}}\right) \times \left(\frac{\text{sales}}{\text{total assets}}\right) \times \left(\frac{\text{total assets}}{\text{stockholders' equity}}\right)$$

This has also been called the PRAT model, where SGR is a function of the profit margin (P), the retention rate (R), the asset turnover (A), and the degree of financial leverage (T). Use beginning-of-period balance sheet values unless otherwise instructed.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 20.1

1. **C** Residual income models are the best valuation method if the firm does not pay dividends, has negative free cash flow over the forecast horizon, and has transparent financial reporting and high earnings quality. (LOS 20.a)

Module Quiz 20.2

1. **A** The value of a perpetuity (equal payments forever) is equal to annual cash flow divided by required return:

$$V = \frac{C\$5.00}{0.09} = C\$55.56$$

(LOS 20.d)

2. **C** The constant DDM can be used to solve for the required rate of return:

$$r = \frac{D_0 \times (1+g)}{P_0} + g = \frac{\$2.50 \times 1.08}{\$89} + 0.08 = 0.110 = 11.0\%$$

(LOS 20.c)

3. **B** Solve the following equation for g:

$$30.28 = \frac{2(1+g)}{0.13-g}$$

$$30.28(0.13-g) = 2(1+g)$$

$$3.9364 - 30.28g = 2 + 2g$$

$$1.9364 = 32.28g$$

$$g = 6\%$$

(LOS 20.c)

4. **A** The growth rate is –3%. Therefore,

$$\text{stock value} = \frac{D_1}{r-g} = \frac{\$4.00}{0.09-(-0.03)} = \$33.33.$$

(LOS 20.c)

5. **A** We calculate the value of the expected cash flows at nine years because the formula uses the value of the dividend of t + 1 and then discounts that value to the present at the required rate of return of 12%.

$$V_9 = \frac{\$1.25}{0.12-0.04} = \$15.63$$

$$V_0 = \frac{\$15.63}{1.12^9} = \$5.64$$

(LOS 20.c)

6. **A** EBEE's stock price today can be calculated using the two-stage model. Start by finding the value of the dividends during the high-growth period of five years.

$D_1 = D_0(1 + g)^1 = \$2.50(1.30)^1 = \$3.25$

$D_2 = D_0(1 + g)^2 = \$2.50(1.30)^2 = \$4.225$

$D_3 = D_0(1 + g)^3 = \$2.50(1.30)^3 = \$5.493$

$D_4 = D_0(1 + g)^4 = \$2.50(1.30)^4 = \$7.140$

$D_5 = D_0(1 + g)^5 = \$2.50(1.30)^5 = \$9.282$

(Alternatively, you could use your financial calculator to solve for the future value to find D_1, D_2, D_3, D_4, and D_5.)

Next find the value of the stock at the beginning of the constant growth period using the constant growth model: $P_5 = \frac{D_6}{r - g}$

CAPM: $r = 0.05 + (1.2 \times 0.06) = 0.122$

$D_6 = D_5 \times (1 + g) = \$9.282 \times 1.07 = \$9.932$

$P_5 = \frac{D_6}{r - g} = \frac{\$9.932}{0.122 - 0.07} = \$191.00$

The easiest way to proceed is to use the NPV function on the financial calculator.

$CF_0 = 0$; $CF_1 = 3.25$; $CF_2 = 4.225$; $CF_3 = 5.493$; $CF_4 = 7.140$;
$CF_5 = 9.282 + 191.00 = 200.282$

$I = 12.2$; $NPV = 127.28$

The value of the firm today is \$127.28 per share. (LOS 20.b)

Module Quiz 20.3

1. **B** Based on its fundamentals, Aerosail is most appropriately categorized as being in the transition phase. Multistage models are most appropriate for valuing firms in the transition phase. (LOS 20.k)

2. **B** Solve for the internal rate of return of the expected cash flows.

CF0 = –39.71
C01 = 1.00
C02 = 2.00
C03 = 54.50 = 52.00 + 2.50 CPT → IRR 13.5% (LOS 20.n)

3. **B** Sustainable growth is equal to return on equity multiplied by retention ratio:

SGR(AAA) = 0.30 × 0.40 = 0.120 = 12.0%

SGR(TST) = 0.22 × 0.30 = 0.66 = 6.6%

(LOS 20.p)

4. **C** The required returns for the two companies based on the CAPM are calculated below.

AAA: $r = 0.04 + 1.2(0.11 - 0.04) = 0.04 + 0.084 = 0.124$

TST: $r = 0.04 + 0.9(0.11 - 0.04) = 0.04 + 0.063 = 0.103$

The current values of the two stocks using the constant DDM are calculated next.

Sustainable growth is equal to return on equity multiplied by retention ratio:

$SGR(AAA) = 0.30 \times 0.40 = 0.120 = 12.0\%$

$SGR(TST) = 0.22 \times 0.30 = 0.66 = 6.6\%$

Current dividend is current EPS multiplied by payout ratio:

$$P_0(AAA) = \frac{\$1.50 \times 1.12}{0.124 - 0.12} = \$420.00$$

$$P_0(TST) = \frac{\$3.22 \times 1.066}{0.103 - 0.066} = \$92.77$$

Value is calculated with the Gordon constant growth model:

$$P_0(AAA) = \frac{\$1.50 \times 1.12}{0.124 - 0.12} = \$420.00$$

$$P_0(TST) = \frac{\$3.22 \times 1.066}{0.103 - 0.066} = \$92.77$$

(LOS 20.b)

5. **A** AAA's stock price today can be calculated using the two-stage model. Start by finding the value of the dividends during the high growth period of five years.

D_0 = (current EPS)(1 – retention ratio) = $\$2.50 \times (1 - 0.40) = \$1.50$

$D_1 = D_0(1 + g)^1 = \$1.50(1.2)^1 = \$1.800$

$D_2 = D_0(1 + g)^2 = \$1.50(1.2)^2 = \$2.160$

$D_3 = D_0(1 + g)^3 = \$1.50(1.2)^3 = \$2.592$

$D_4 = D_0(1 + g)^4 = \$1.50(1.2)^4 = \$3.110$

Next, find the value of the stock at the beginning of the constant growth period using the constant dividend discount model: $P_4 = \frac{D_5}{r - g}$

CAPM: $r = 0.04 + (1.2 \times 0.07) = 0.124$

$$D_5 = D_4 \times (1 + g) = \$3.11 \times 1.07 = \$3.3277$$

$$P_4 = \frac{D_5}{r - g} = \frac{\$3.3277}{0.124 - 0.07} = \$61.624$$

The easiest way to proceed is to use the NPV function in the financial calculator.

$CF_0 = 0$; $CF_1 = 1.8$; $CF_2 = 2.16$; $CF_3 = 2.592$; $CF_4 = 3.110 + 61.624 = 64.734$

$I = 12.4$; $NPV = 45.69$

The value of the firm today is $45.69 per share. (LOS 20.n)

6. **C** The estimated value of AAA using the H-model is calculated as follows:

$$V_0 = \frac{(\$1.50 \times 1.07) + \left[\$1.50 \times \frac{4}{2} \times (0.20 - 0.07)\right]}{0.153 - 0.07} = \$24.04$$

The estimated value of TST using the H-model is calculated as follows:

$$V_0 = \frac{(\$3.22 \times 1.05) + \left[\$3.22 \times \frac{4}{2} \times (0.15 - 0.05)\right]}{0.126 - 0.05} = \$52.96$$

(LOS 20.n)

7. **B** Required rate of return from the macroeconomic multifactor model:

AAA: $0.04 + (0.048 \times 0.63) + (0.031 \times 0.47) + (0.045 \times 0.70) + (0.038 \times 0.98) + (-0.018 \times 0.05) = 0.1527$

TST: $0.04 + (0.048 \times 0.42) + (0.031 \times 0.39) + (0.045 \times 0.51) + (0.038 \times 0.91) + (-0.018 \times 0.21) = 0.126$

$$\text{justified leading P/E (AAA)} = \frac{1 - b}{r - g} = \frac{0.6}{0.1527 - 0.07} = 7.26$$

$$\text{justified leading P/E (TST)} = \frac{1 - b}{r - g} = \frac{0.7}{0.126 - 0.05} = 9.21$$

(LOS 20.h)

8. **C** $\text{ROE} = \frac{\$322}{\$1,875 - \$1,465} = 78.5\%$ (LOS 20.p)

9. **C** The higher ROE for JFOI is largely due to higher leverage. Assets-to-equity for the industry is calculated as:

$0.405 = 0.1570 \times 1.1 \times (\text{assets/equity}) \Rightarrow (\text{assets/equity}) = 2.35$

The ratios for JFOI are calculated as:

$$(\text{NI/sales}) = \frac{\$322}{\$2,044} = 0.1575$$

$$(\text{sales/assets}) = \frac{\$2,044}{\$1,875} = 1.09$$

$$(\text{assets/equity}) = \frac{\$1,875}{\$1,875 - \$1,465} = \frac{\$1,875}{\$410} = 4.57$$

The comparison of DuPont equations for JFOI and the industry are shown below.

ROE = profitability × asset efficiency × leverage

ROE = NI/sales × sales/assets × assets/equity

Industry: $0.405 = 0.1570 \times 1.1 \times 2.35$

JFOI: $0.785 = 0.1575 \times 1.09 \times 4.57$

Therefore, the higher leverage resulted in a larger ROE for JFOI relative to the industry. (LOS 20.p)

10. **C** The H-model uses a half-life factor equal to one-half of the declining stage in years. This approach values the dividend growth at the long-term rate and

adds an estimate for the additional value of the supernormal growth during the first stage.

$$V = \frac{[€2.00 \times (1.10)] + \left[€2.00 \times \frac{4}{2} \times (0.20 - 0.10)\right]}{0.18 - 0.10} = €32.50$$

(LOS 20.i)

11. **C** $D_1 = 2(1.20) = €2.40$; $D_2 = 2(1.20)^2 = €2.88$; $D_3 = 2(1.20)^3 = 3.46$; $D_4 = 2(1.20)^4 = €4.15$

$$P_4 = \frac{D_5}{r - g} = \frac{2(1.20)^4(1.10)}{0.18 - 0.10} = €57.02$$

$$PV(D_1, D_2, D_3, D_4 + P_4; r = 18\%) = €37.76$$

(LOS 20.n)

12. **C** Stock P has model price higher than the market price and hence is undervalued by the market. Stock Q has model price lower than the market price and hence is overvalued. Stock R has model price equal to the market price and hence is fairly valued. (LOS 20.j)

13. **C** The PVGO must be less than zero because the ROE is less than the required return, but the firm is still retaining and reinvesting its cash flow. That means it is destroying value!

$$D_1 = \$4.50 \times 0.40 = \$1.80$$

$$g = 0.0833 \times (1 - 0.4) = 0.05 = 5\%$$

$$V_0 = \frac{\$1.80}{0.15 - 0.05} = \$18.00$$

$$V_0 = \frac{E}{r} + PVGO$$

$$PVGO = V_0 - \frac{E}{r} = \$18.00 - \frac{\$4.50}{0.15} = \$18.00 - \$30.00 = -\$12.00$$

(LOS 20.g)

READING 21

FREE CASH FLOW VALUATION

EXAM FOCUS

This topic review introduces the concept of free cash flow. The value of a firm's stock is calculated by forecasting free cash flow to the firm (FCFF) or free cash flow to equity (FCFE) and discounting these cash flows back to the present at the appropriate required rate of return. FCFF or FCFE are the appropriate models to use when (1) the firm doesn't pay dividends at all or pays out fewer dividends than dictated by its cash flow, (2) free cash flow tracks profitability, or (3) the analyst takes a corporate control perspective. Make sure you see the parallels between the free cash flow framework and the discounted dividend framework (i.e., the basic free cash flow model is analogous to the Gordon growth model). Memorize the formulas for FCFF and FCFE. This is a very important test topic, as many analysts prefer free cash flow models to dividend discount models.

MODULE 21.1: FCF COMPUTATION

Video covering this content is available online.

Warm-Up: Free Cash Flow

Forget about all the complicated financial statement relationships for a minute and simply picture the firm as a cash *processor*. Cash flows into the firm in the form of revenue as it sells its product, and cash flows out as it pays its cash operating expenses (e.g., salaries and taxes, but not interest expense, which is a financing and not an operating expense). The firm takes the cash that's left over and makes short-term net investments in working capital (e.g., inventory and receivables) and long-term investments in property, plant, and equipment (PP&E). The cash that remains is available to pay out to the firm's investors: bondholders and common shareholders (let's assume for the moment that the firm has not issued preferred stock). That pile of remaining cash is called **free cash flow to the firm (FCFF)** because it's *free* to pay out to the firm's investors (see Figure 21.1). The formal definition of FCFF is the cash available to all of the firm's investors, including stockholders and bondholders, after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investments.

PROFESSOR'S NOTE

Taxes paid are included in the definition of cash operating expenses for purposes of defining free cash flow, even though taxes aren't generally considered a part of operating income.

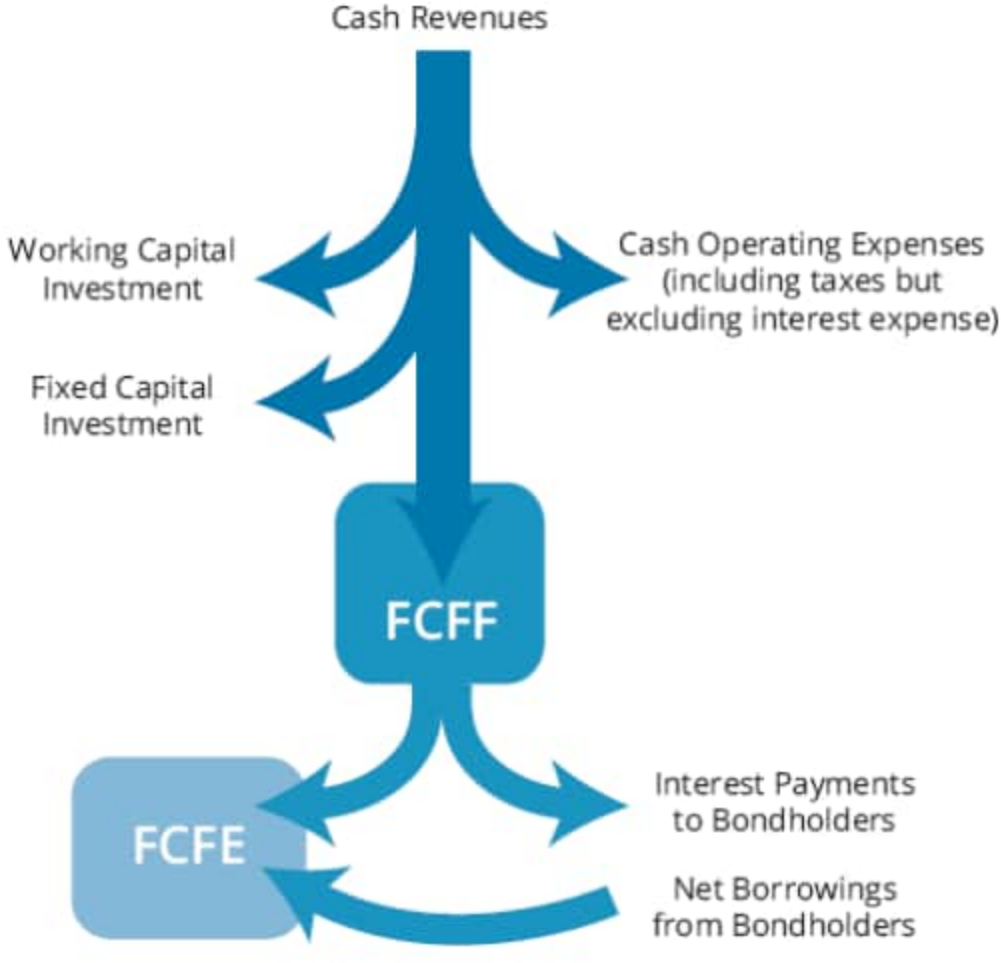
What does the firm do with its FCFF? First, it takes care of its bondholders because common shareholders are paid after all creditors. So it makes interest payments to bondholders and borrows more money from them or pays some of it back. However, making interest payments to bondholders has one advantage for common shareholders: it reduces the tax bill.

The amount that's left after the firm has met all its obligations to its other investors is called **free cash flow to equity (FCFE)**, as can be seen in Figure 21.1. However, the board of directors still has discretion over what to do with that money. It could pay it all out in dividends to its common shareholders, but it might decide to only pay out some of it and put the rest in the bank to save for next year. That way, if FCFE is low the next year, it won't have to cut the dividend payment. So FCFE is the cash available to common shareholders after funding capital requirements, working capital needs, and debt financing requirements.

PROFESSOR'S NOTE

You need to know these general definitions. We will explore how these two cash flow measures are estimated using accounting data, and in the process we'll throw a lot of formulas at you. It's much easier to remember these formulas and repeat them on the exam if you have a conceptual understanding of what FCFF and FCFE represent. That way if, for example, you happen to forget the FCFE formula on exam day, you still have a chance to reconstruct it by thinking through what FCFE really is.

Figure 21.1: FCFF and FCFE



PROFESSOR'S NOTE

You may be wondering, why does net borrowing affect FCFE but not FCFF? Think of FCFF as the cash flow generated by the firm's core business. Borrowing isn't generated by the firm's core business, so net borrowing has no impact on FCFF. On the other hand, think of FCFE as cash that could be given to shareholders, if management wanted to. Net borrowing increases FCFE.

LOS 21.a: Compare the free cash flow to the firm (FCFF) and free cash flow to equity (FCFE) approaches to valuation.

We will use the typical discounted cash flow technique for free cash flow valuation, in which we estimate value today by discounting expected future cash flows at the appropriate required return. What makes this complicated is that we'll end up with two values we want to estimate (firm value and equity value), two cash flow definitions (FCFF and FCFE), and two required returns [weighted average cost of capital (WACC) and required return on equity]. The key to this question on the exam is knowing which *cash flows* to discount at which *rate* to estimate which *value*.

The value of the *firm* is the present value of the expected future *FCFF* discounted at the *WACC* (this is so important we're going to repeat it as a formula):

firm value = FCFF discounted at the WACC

The weighted average cost of capital is the required return on the firm's assets. It's a weighted average of the required return on common equity and the after-tax required return on debt. The formula is presented later in this topic review.

PROFESSOR'S NOTE

Technically, what we've called firm value is actually the value of the operating assets (the assets that generate cash flow). Significant nonoperating assets, such as excess cash (not total cash on the balance sheet), excess marketable securities, or land held for investment should be added to this estimate to calculate total firm value. Most of the time, the value of these assets is small in relation to the present value of the FCFFs, so we don't lose much by ignoring it. If you are asked to calculate the value of the firm using the FCFF approach, calculate the present value of the FCFFs and then look for any additional information in the problem that specifically says "excess cash and marketable securities" or "land held for investment."

The value of the firm's *equity* is the present value of the expected future *FCFE* discounted at the *required return on equity*:

equity value = FCFE discounted at the required return on equity

Given the value of the firm, we can also calculate equity value by simply subtracting out the market value of the debt:

equity value = firm value − market value of debt

Details of the calculations are discussed later in this topic review. However, this is an extremely important concept, so memorize it now.

PROFESSOR'S NOTE

A very common mistake is to use the wrong discount rate or the wrong cash flow definition. Remember, always discount FCFF at the WACC to find firm value, and discount FCFE at the required return on equity to estimate equity value.

The differences between FCFF and FCFE account for differences in capital structure and consequently reflect the perspectives of different capital suppliers. FCFE is easier and more straightforward to use in cases where the company's capital structure is not particularly volatile. On the other hand, if a company has negative FCFE and significant debt outstanding, FCFF is generally the best choice. We can always estimate equity value indirectly by discounting FCFF to find firm value and then subtracting the market value of debt to arrive at equity value.

When a firm's capital structure is volatile, the **adjusted present value (APV)** approach can also be used. Under the APV approach, the firm's unlevered cash flows (i.e., cash flows assuming no impact of leverage) are discounted at the firm's unlevered cost of equity. NPV of debt (the value of the tax shield, less the cost of financial distress) is then added to the unlevered value.

LOS 21.b: Explain the ownership perspective implicit in the FCFE approach.

The ownership perspective in the free cash flow approach is that of an acquirer who can change the firm's dividend policy, which is a control perspective, or for minority shareholders of a company that is *in-play* (i.e., it is a takeover target with potential bidders). The ownership perspective implicit in the dividend discount approach is that of a minority owner who has no direct control over the firm's dividend policy. If investors are willing to pay a premium for control of the firm, there may be a difference between the values of the same firm derived using the two models.

Analysts often prefer to use free cash flow rather than dividend-based valuation for the following reasons:

- Many firms pay no, or low, cash dividends.
- Dividends are paid at the discretion of the board of directors. It may, consequently, be poorly aligned with the firm's long-run profitability.
- If a company is viewed as an acquisition target, free cash flow is a more appropriate measure because the new owners will have discretion over its distribution (control perspective).
- Free cash flows may be more related to long-run profitability of the firm as compared to dividends.

MODULE QUIZ 21.1

1. Chamber Group is analyzing the potential takeover of Outmenu, Inc. Chamber has gathered the following data on Outmenu. All figures are in millions of dollars.

	2023	2022	2021	2020
Net income	–$26	$34	$18	$26
FCFE	–$1	–$23	$14	–$15
FCFF	$3	$4	$6	$8
Dividends	$5	$5	$4	$4
Debt-to-equity	93%	91%	78%	84%

The *most appropriate* model for valuing Outmenu is the:

A. free cash flow to equity model.
B. dividend discount H-model.
C. free cash flow to the firm model.

2. An analyst calculates firm value using a single-stage model on December 31, 2023, as:

$$\text{value of the firm} = \frac{FCFE_{2024}}{r - g} + MVD$$

where:
$FCFE_{2024}$ = free cash flow to equity forecast for 2024
r = required return on equity
g = growth rate in FCFE
MVD = market value of debt on 12/31/2023

Assuming there are no nonoperating assets on the balance sheet, the analyst has *most likely*:

A. correctly calculated firm value.
B. incorrectly calculated firm value. The weighted average cost of capital should be substituted for the required return on equity.
C. incorrectly calculated firm value. The weighted average cost of capital should be substituted for the required return on equity, and $FCFE_{2023}(1 + g)$ should be substituted for $FCFE_{2024}$.

MODULE 21.2: FIXED CAPITAL AND WORKING CAPITAL

Video covering this content is available online.

LOS 21.c: Explain the appropriate adjustments to net income, earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), and cash flow from operations (CFO) to calculate FCFF and FCFE.

You may feel overwhelmed by the formulas in this topic review. We'll show you the ones you need to know for this LOS without showing you the derivations. The basic idea is that we can arrive at FCFF by starting with one of four different financial statement items (net income, EBIT, EBITDA, or cash flow from operations [CFO]) and then making the appropriate adjustments. Then we can calculate FCFE from FCFF or by starting with net income or CFO.

Calculating FCFF from net income. FCFF is calculated from net income as:

$$FCFF = NI + NCC + [Int \times (1 - \text{tax rate})] - FCInv - WCInv$$

where:
NI = net income
NCC = noncash charges
Int = interest expense
FCInv = fixed capital investment (capital expenditures)
WCInv = working capital investment

Notice that net income does not represent free cash flows defined as FCFF, so we have to make four important adjustments to net income to get to FCFF: noncash charges, fixed capital investment, working capital investment, and interest expense.

Noncash charges. Noncash charges are added back to net income to arrive at FCFF because they represent expenses that reduced reported net income but didn't actually result in an outflow of cash. The most significant noncash charge is usually depreciation. Here are some other examples of noncash charges that often appear on the cash flow statement:

- Amortization of intangibles should be added back to net income, much like depreciation.
- Provisions for restructuring charges and other noncash losses should be added back to net income. However, if the firm is accruing these costs to cover future cash outflows, then the forecast of future free cash flow should be reduced accordingly. Gains or losses on sale of long-term assets are also removed (they would be accounted for under fixed capital investment).
- Income from restructuring charge reversals and other noncash gains should be subtracted from net income.
- For a bond issuer, the amortization of a bond discount should be added back to net income, and the accretion of the bond premium should be subtracted from net income to calculate FCFF.
- Deferred taxes, which result from differences in the timing of reporting income and expenses for accounting versus tax purposes, must be carefully analyzed. Over time, differences between book and taxable income should offset each other and have no significant effect on overall cash flows. If, however, the analyst expects deferred tax liabilities to continue to increase (i.e., not reverse), increases in deferred tax liabilities should be added back to net income. Increases in deferred tax assets that are not expected to reverse should be subtracted from net income.

Fixed capital investment. Investments in fixed capital do not appear on the income statement, but they do represent cash leaving the firm. That means we have to subtract them from net income to estimate FCFF. Fixed capital investment is a net amount: it is equal to the difference between capital expenditures (investments in long-term fixed assets) and the proceeds from the sale of long-term assets:

$$FCInv = \text{capital expenditures} - \text{proceeds from sales of long-term assets}$$

Both capital expenditures and proceeds from long-term asset sales (if any) are likely to be reported on the firm's statement of cash flows, as cash flow from investing activities (CAPEX acquired via a non-cash exchange would be reported in the footnotes). If no long-term assets were sold during the year, then capital

expenditures will also equal the change in the gross PP&E account from the balance sheet. However, gross PP&E is often not provided; in that case we can use the formula based on net PP&E (shown in the following).

If no long-term assets were sold during the year:

FCInv = ending net PP&E – beginning net PP&E + depreciation

If long-term assets were sold during the year, then:

- Determine capital expenditures from either (1) an item in the statement of cash flows called something like "purchase of fixed assets" or "purchases of PP&E" under cash flow from investing activities, or (2) data provided in the vignette.
- Determine proceeds from sales of fixed assets from either (1) an item in the statement of cash flows called something like "proceeds from disposal of fixed assets," or (2) data provided in the vignette.
- Calculate FCInv = capital expenditures – proceeds from sale of long-term assets.
- If capital expenditures or sales proceeds are not given directly, find gain (loss) on asset sales from the income statement and PP&E figures from balance sheet. Calculate FCInv = ending net PP&E – beginning net PP&E + depreciation – gain on sale. If there is a loss on sale of assets, add that instead of deducting it.

EXAMPLE: Calculating FCInv with no long-term asset sales

Airbrush, Inc., financial statements for 2023 include the following information:

Selected Financial Data

	2023	2022
Gross PP&E	$5,000	$4,150
Accumulated depreciation	$1,500	$1,200
Net PP&E	$3,500	$2,950

There were no sales of PP&E during the year; depreciation expense was $300. Calculate Airbrush's FCInv for 2023.

Answer:

$$\begin{aligned} \text{FCInv} &= \text{capital expenditures} \\ &= \text{ending net PP\&E} - \text{beginning net PP\&E} + \text{depreciation} \\ &= \$3,500 - \$2,950 + \$300 = \$850 \end{aligned}$$

Note that this is the same as the change in gross PP&E.

EXAMPLE: Calculating FCInv with long-term asset sales

Suppose that Airbrush reports capital expenditures of $1,400, long-term asset sales of $600, and depreciation expense of $850. The long-term assets sold were fully depreciated. Calculate Airbrush's revised FCInv for 2023.

Answer:

$$\begin{aligned} \text{revised FCInv} &= \text{capital expenditures} - \text{proceeds from sales of long-term assets} \\ &= \$1,400 - \$600 = \$800 \end{aligned}$$

Working capital investment. The investment in net working capital is equal to the change in working capital, *excluding cash, cash equivalents, notes payable, and the current portion of long-term debt*. Note that there would be a + sign in front of a *reduction* in working capital; we would add it back because it represents a cash inflow.

Interest expense. Interest was expensed on the income statement, but it represents a financing cash flow to bondholders that is available to the firm *before* it makes any payments to its capital suppliers. Therefore, we have to add it back. However, we don't add back the *entire* interest expense, only the *after-tax* interest cost, because paying interest reduces our tax bill. For example, if the marginal tax rate is 30%, every dollar of interest paid reduces the tax bill by 30 cents. The net effect on free cash flow is an increase in the after-tax interest cost of 70 cents.

MODULE 21.3: VARIATIONS OF FORMULAE

Video covering this content is available online.

Figure 21.2: Calculating FCFF and FCFE Using the Statement of Cash Flows

Statement of Cash Flows	FCFF and FCFE
Net income (NI)	Net income (NI)
+ Noncash charges (NCC)	+ Noncash charges (NCC)
– WCInv	– WCInv
Cash flow from operations (CFO)	Cash flow from operations (CFO)
	+ Int (1 – tax rate)
– FCInv	– FCInv
(Almost) FCFF	**(Actual) FCFF**
+ Net borrowing	+ Net borrowing
	– Int (1 – tax rate)
FCFE	**FCFE**
– Dividends	– Dividends
+/– Common stock issues (repurchases)	+/– Common stock issues (repurchases)
Net change in cash	Net change in cash

After-tax interest expense is classified as financing outflow rather than operating outflow

Unfortunately, you have to memorize a number of free cash flow formulas to be fully prepared for the exam. However, we can use the statement of cash flows (as it is required to be reported under U.S. GAAP) as a framework to provide some intuition concerning the free cash flow formulas and perhaps make it a little easier to remember these formulas.

Given our conceptual discussion of FCFF and FCFE, it would make sense to define them as shown in the first column of Figure 21.2.

PROFESSOR'S NOTE
Depreciation is added back in full because we will claim it on our taxes, yet it doesn't represent an actual cash flow. Interest isn't added back in full, because if we retain that cash, we'll have lower interest expense, and thus higher tax.

Free cash flow to the firm is the operating cash flow left after the firm makes working capital and fixed capital investment. Therefore, we can get close to the actual calculation by using the first column in Figure 21.2:

$$\begin{aligned}\text{(Almost) FCFF} &= (\text{NI} + \text{NCC} - \text{WCInv}) - \text{FCInv} \\ &= \text{CFO} - \text{FCInv}\end{aligned}$$

We're not quite there, however, because of one unique feature of the statement of cash flows: interest expense is considered an operating cash flow, whereas we'd like to call it a financing cash flow. Because interest is tax deductible, the after-tax interest expense [interest × (1 – tax rate)] reduces net income; but we want to add it back to net income and then subtract it out as a financing cash outflow. By doing that, we go from our (almost) definition to the actual formula for FCFF (as shown in the second column in Figure 21.2):

$$\begin{aligned}\text{(Actual) FCFF} &= (\text{NI} + \text{NCC} - \text{WCInv}) + \text{Int}(1 - \text{tax rate}) - \text{FCInv} \\ &= \text{CFO} + \text{Int}(1 - \text{tax rate}) - \text{FCInv}\end{aligned}$$

We can also use the second column format to calculate FCFE directly from FCFF:

$$\text{FCFE} = \text{FCFF} - \text{Int}(1 - \text{tax rate}) + \text{net borrowing}$$

Notice that any financial decisions that affect cash flows below FCFE (e.g., dividends, share repurchases, and share issues) do not affect FCFF or FCFE.

Calculating FCFF from EBIT. FCFF can also be calculated from earnings before interest and taxes (EBIT):

$$\text{FCFF} = [\text{EBIT} \times (1 - \text{tax rate})] + \text{Dep} - \text{FCInv} - \text{WCInv}$$

where:
EBIT = earnings before interest and taxes
Dep = depreciation

If we start with earnings before interest and taxes (EBIT), we have to add back depreciation because it was subtracted out to get to EBIT. However, because EBIT is before interest and taxes, we don't have to take out interest (remember that it's a financing cash flow). We do have to adjust for taxes, though, by computing after-tax EBIT, which is EBIT multiplied by one minus the tax rate. We also make the same adjustments as we did before by subtracting out fixed capital and working capital investment.

PROFESSOR'S NOTE
Because many noncash adjustments occur on the income statement below EBIT, we don't need to adjust for them when calculating free cash flow if we start with EBIT. We assume that the only noncash charge that appears above

EBIT is depreciation in the equation "FCFF from EBIT." In general, however, the rule is to adjust for any noncash charge that appears on the income statement above the income statement item you're starting with.

Calculating FCFF from EBITDA. We can also start with earnings before interest, taxes, depreciation, and amortization (EBITDA) to arrive at FCFF:

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

where:
EBITDA = earnings before interest, taxes, depreciation, and amortization

Remember that EBITDA is before depreciation, so we only have to add back the depreciation tax shield, which is depreciation multiplied by the tax rate. Even though depreciation is a noncash expense, the firm reduces its tax bill by expensing it, so the free cash flow available is increased by the taxes saved.

Calculating FCFF from CFO. Finally, FCFF can also be estimated by starting with cash flow from operations (CFO) from the statement of cash flows:

$$\text{FCFF} = \text{CFO} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv}$$

where:
CFO = cash flow from operations

Cash flow from operations is equal to net income plus noncash charges less working capital investment. We have to add back to CFO the after-tax interest expense to get to FCFF because interest expense (and the resulting tax shield) was reflected on the income statement to arrive at net income. We also have to subtract out fixed capital investment since CFO only includes changes in working capital investment.

PROFESSOR'S NOTE
Which formula should you use on the exam? I suggest that, at a minimum, you memorize the first one (that starts with net income) and the last one (that starts with cash flow from operations). That way, given either an income statement or a cash flow statement, you can calculate FCFF. However, don't be surprised if you're required to know the other two as well.

Calculating FCFE from FCFF. Calculating FCFE is easy once we have FCFF:

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] + \text{net borrowing}$$

where:
net borrowing = long- and short-term new debt issues − long- and short-term debt repayments

If we start with FCFF, we have to adjust for the two cash flows to bondholders to calculate FCFE: the after-tax interest expense and any new long- or short-term borrowings. We only subtract the after-tax interest expense because paying interest reduces the firm's tax bill and reduces the cash available to the shareholders by the interest paid minus the taxes saved.

Calculating FCFE from net income. We can also calculate FCFE from net income by making some of the usual adjustments. The two differences between this "FCFE from net income" formula and the "FCFF from net income formula" are (1) after-tax interest expense is not added back and (2) net borrowing is added back.

FCFE = NI + NCC – FCInv – WCInv + net borrowing

Calculating FCFE from CFO. Finally, we can calculate FCFE from CFO by subtracting out fixed capital investment (which reduces cash available to shareholders) and adding back net borrowing (which increases the cash available to shareholders).

FCFE = CFO – FCInv + net borrowing

Free Cash Flow With Preferred Stock

The FCFF and FCFE formulas assume that the company uses only debt and common equity to raise funds. The use of preferred stock requires the analyst to revise the FCFF and FCFE formulas to reflect the payment of preferred dividends and any issuance or repurchase of such shares. *Remember to treat preferred stock just like debt, except preferred dividends are not tax deductible.*

Specifically, any preferred dividends should be added back to the FCFF, just as after-tax interest charges are in the net income approach to generating FCFF. This approach assumes that *net income* is net income to common shareholders after preferred dividends have been subtracted out. The WACC should also be revised to reflect the percent of total capital raised by preferred stock and the cost of that capital source. The only adjustment to FCFE would be to modify net borrowing to reflect new debt borrowing and net issuances by the amount of the preferred stock. Keep in mind that relatively few firms issue preferred stock.

MODULE QUIZ 21.2, 21.3

Use the following information to answer Questions 1 through 3.

Meyer Henderson, CFA, is analyzing the financials of Roth Department Stores. He intends to use a free cash flow to the firm (FCFF) model to value Roth's common stock. In the 2023 financial statements and footnotes he has identified the following items:

- Item #1: Roth reported depreciation and software amortization of $23 million in 2023.
- Item #2: The deferred tax liability increased by $17 million in 2023.
- Item #3: Roth reported income of $6 million in 2023 from the reversal of previous restructuring charges related to store closings in 2022.
- Item #4: Net income totaled $173 million in 2023.
- Item #5: The net increase in noncash net working capital accounts was $47 million in 2023.
- Item #6: Net capital spending totaled $86 million in 2023.
- Item #7: Roth reported interest expense of $19 million.

Henderson estimated Roth's marginal tax rate to be 35%. He also expects Roth to be profitable for the foreseeable future, so he does not expect the deferred tax liability to reverse. As the base-year projection for his FCFF valuation, Henderson calculates FCFF for 2023 as:

$$\begin{aligned} FCFF_{2023} &= \$173 + \$23 + \$6 + \$17 + [\$19(1 - 0.35)] - \$86 - \$47 \\ &= \$98.35 \text{ million} \end{aligned}$$

1. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #1 and #2?

A. Both items were treated correctly.
B. One item was treated correctly and the other incorrectly.
C. Neither item was treated correctly.

2. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #3 and #4?
   A. Both items were treated correctly.
   B. One item was treated correctly and the other incorrectly.
   C. Neither item was treated correctly.
3. In implementing the FCFF model to value Roth, did Henderson correctly treat Items #5 and #7?
   A. Both items were treated correctly.
   B. One item was treated correctly and the other incorrectly.
   C. Neither item was treated correctly.
4. Imagine that we are provided the following information for a firm:
   - Net income = $50.
   - Working capital investment = $4.
   - Beginning gross fixed assets = $90; ending gross fixed assets = $136.
   - Beginning accumulated depreciation = $30; ending accumulated depreciation = $40.
   - Depreciation expense = $27.
   - Net borrowing = $0.

   In addition, a piece of equipment with an original book value of $19 was sold for $10. The equipment had a book value at the time of the sale of $2. The gain was classified as unusual. Free cash flow to equity is *closest* to:
   A. $6.
   B. $10.
   C. $18.
5. Suppose an analyst uses the statement of cash flows to calculate free cash flow to the firm (FCFF) as cash flow from operations less fixed capital investment, and free cash flow to equity (FCFE) as FCFF (calculated as before) plus net borrowing. The firm has short- and long-term debt on its balance sheet. Has the analyst correctly stated, overstated, or understated FCFF and FCFE?

	FCFF	FCFE
A.	Overstated	Correct
B.	Understated	Understated
C.	Understated	Correct

MODULE 21.4: EXAMPLE

Video covering this content is available online.

LOS 21.d: Calculate FCFF and FCFE.

Let's try an example to see if all these formulas really work.

EXAMPLE: Calculating FCFF and FCFE

Anson Ford, CFA, is analyzing the financial statements of Sting's Delicatessen. He has a 20X6 income statement and balance sheet, as well as 20X7 income statement, balance sheet, and cash flow from operations forecasts (as shown in the following tables). Assume there will be no sales of long-term assets in 20X7.

Calculate forecasted free cash flow to the firm (FCFF) and free cash flow to equity (FCFE) for 20X7.

Sting's Income Statement

Income Statement		
	20X7 Forecast	**20X6 Actual**
Sales	$300	$250
Cost of goods sold	120	100
Gross profit	180	150
SG&A	35	30
Depreciation	50	40
EBIT	95	80
Interest expense	15	10
Pre-tax earnings	80	70
Taxes (at 30%)	24	21
Net income	$56	$49

Sting's Balance Sheet

Balance Sheet		
	20X7 Forecast	**20X6 Actual**
Cash	$10	$5
Accounts receivable	30	15
Inventory	40	30
Current assets	$80	$50
Gross property, plant, and equipment	400	300
Accumulated depreciation	(190)	(140)
Total assets	$290	$210
Accounts payable	$20	$20
Short-term debt	20	10
Current liabilities	$40	$30
Long-term debt	114	100
Common stock	50	50
Retained earnings	86	30
Total liabilities and owners' equity	$290	$210

Sting's Cash Flow From Operations Forecast

Cash Flow From Operations Forecast for 20X7	
Net income	$56
+ depreciation	50
– WCInv	25
Cash flow from operations	$81

Answer:

Fixed capital investment is equal to capital expenditures (because there are no asset sales), which is equal to the change in net PP&E plus depreciation:

$$\text{Net PP\&E 20X6} = (\text{gross PP\&E}) - (\text{accumulated depreciation})$$
$$= 300 - 140 = 160$$

$$\text{FCInv} = (\text{ending net PP\&E} - \text{beginning net PP\&E}) + \text{depreciation}$$
$$= (210 - 160) + 50$$
$$= 100$$

Working capital investment is the change in the working capital accounts, excluding cash and short-term borrowings:

$$\text{WCInv} = (\text{AcctsRec}_{20X7} + \text{Inv}_{20X7} - \text{AcctsPay}_{20X7}) - (\text{AcctsRec}_{20X6} + \text{Inv}_{20X6} - \text{AcctsPay}_{20X6})$$

$$\text{WCInv} = (30 + 40 - 20) - (15 + 30 - 20) = 50 - 25 = 25$$

Given that depreciation is the only noncash charge, we can calculate FCFF from net income:

$$\text{FCFF} = \text{NI} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv} - \text{WCInv}$$
$$= 56 + 50 + [15 \times (1 - 0.3)] - 100 - 25 = -8.5$$
$$= 56 + 50 + 10.5 - 100 - 25 = -8.5$$

It's entirely possible that FCFF can be negative in the short term. We'll talk more later about how to value firms with negative FCFF.

Net borrowing is the difference between the new debt issues and debt repayments, and is calculated as the change in long- and short-term debt:

$$\text{net borrowing} = (\text{ending long- and short-term debt}) - (\text{beginning long- and short-term debt}) =$$
$$(114 + 20) - (100 + 10) = 24$$

$$\text{FCFE} = \text{FCFF} - [\text{Int}(1 - \text{tax rate})] + \text{net borrowing}$$
$$= -8.5 - 10.5 + 24 = 5$$

EXAMPLE: Calculating FCFF and FCFE with the other formulas

Calculate FCFF starting with EBIT, EBITDA, and CFO, and calculate FCFE starting with NI and CFO.

Answer:

$$\begin{aligned}\text{FCFF} &= [\text{EBIT} \times (1 - \text{tax rate})] + \text{Dep} - \text{FCInv} - \text{WCInv}\\ &= [95 \times (1 - 0.3)] + 50 + -100 - 25 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFF} &= [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}\\ &= [145 \times (1 - 0.3)] + (50 \times 0.3) - 100 - 25 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFF} &= \text{CFO} + [\text{Int} \times (1 - \text{tax rate})] - \text{FCInv}\\ &= 81 + [15 \times (1 - 0.3)] - 100 = -8.5\end{aligned}$$

$$\begin{aligned}\text{FCFE} &= \text{NI} + \text{Dep} - \text{FCInv} - \text{WCInv} + \text{net borrowing}\\ &= 56 + 50 - 100 - 25 + 24 = 5\end{aligned}$$

$$\begin{aligned}\text{FCFE} &= \text{CFO} - \text{FCInv} + \text{net borrowing}\\ &= 81 - 100 + 24 = 5\end{aligned}$$

EXAMPLE: Calculating FCFF and FCFE using the statement of cash flows

In order to see how all these formulas fit together, reconstruct the framework from Figure 21.2 using the actual numbers from the previous example.

Answer:

Net income	$56.0	
+ noncash charges	+ 50.0	
− WCInv	− 25.0	
Cash flow from operations		**$81.0**
+ Int (1 − tax rate)	+ 10.5	
− FCInv	− 100.0	
FCFF		**−$8.5**
+ net borrowing	+ 24.0	
− Int (1 − tax rate)	− 10.5	
FCFE		**+$5.0**

An analyst may also be concerned about the uses of cash flow. Typically, this is done to verify the FCFF calculation, as FCFF sources must always equal FCFF uses, and FCFE sources must always equal FCFE uses.

$$\begin{aligned}\text{Uses FCFF} &= \text{changes in cash balances}\\ &\quad + \text{net payments to debt providers}\\ &\quad + \text{net payments to equity stakeholders}\end{aligned}$$

$$\begin{aligned}\text{Uses FCFE} &= \text{changes in cash balances}\\ &\quad + \text{net payments to equity stakeholders}\end{aligned}$$

MODULE QUIZ 21.4

1. The adjustments to cash flow from operations necessary to obtain free cash flow to the firm (FCFF) are:
   A. add noncash charges, subtract fixed capital investment, and subtract working capital investment.
   B. add after-tax interest expense and subtract fixed capital investment.
   C. add net borrowing and subtract fixed capital investment.

MODULE 21.5: FCF OTHER ASPECTS

Video covering this content is available online.

LOS 21.e: Describe approaches for forecasting FCFF and FCFE.

Two approaches are commonly used to forecast future FCFF and FCFE.

The first method is to calculate *historical free cash flow* and apply a growth rate under the assumptions that growth will be constant and fundamental factors will be maintained. For example, we could calculate free cash flow in the most recent year and then forecast it to grow at 8% for four years and 4% forever after that. This is the same method we used for dividend discount models. Note that the growth rate for FCFF is usually different than the growth rate for FCFE.

The second method is to forecast the underlying *components of free cash flow* and calculate each year separately. This is a more realistic, more flexible, and more complicated method because we can assume that each component of free cash flow is growing at a different rate over some short-term horizon. This often ties sales forecasts to future capital expenditures, depreciation expenses, and changes in working capital. Importantly, capital expenditures have two dimensions: outlays that are needed to maintain *existing capacity* and marginal outlays that are needed to support *growth*. Thus, the first type of outlay is related to the current level of sales, and the second type depends on the predicted sales growth.

In forecasting FCFE with the second method, it is common to assume that the firm maintains a *target debt-to-asset ratio* for net new investment in fixed capital and working capital. For example, if the target debt ratio is 40% and fixed capital investment is $60 million, $24 million (0.40 multiplied by $60 million) is assumed to be financed with debt and $36 million with equity. Thus, net borrowing may be expressed without having to specifically forecast underlying debt issuance or repayment. This implies that we can forecast FCFE with the following formula:

$$\text{FCFE} = \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{Dep})] - [(1 - \text{DR}) \times \text{WCInv}]$$

where:
DR = target debt-to-asset ratio

LOS 21.f: Explain how dividends, share repurchases, share issues, and changes in leverage may affect future FCFF and FCFE.

This is a deceptively simple LOS. The short answer is that dividends, share repurchases, and share issues have *no effect* on FCFF and FCFE; changes in leverage have only a minor effect on FCFE and no effect on FCFF.

The reason is very straightforward. FCFF and FCFE represent cash flows available to investors and shareholders, respectively, before any payout decisions. Dividends and share repurchases, on the other hand, represent *uses* of those cash flows; as such, these financing decisions don't affect the level of cash flow *available*. Changes in leverage will have a small effect on FCFE. For example, a decrease in leverage through a repayment of debt will decrease FCFE in the current year and increase forecasted FCFE in future years as interest expense is reduced.

Figure 21.3: Effect of Financing Decisions on Free Cash Flow

	FCFF	FCFE
Dividends	None	None
Share repurchase	None	None
Share issue	None	None
Change in leverage	None	ST & LT effects partially offset*

Note: Share repurchase (or issue) is a *use* of free cash flow; not a determinant.

** For example, if leverage increases, FCFE will be higher in the current year (net borrowing) and lower in future years (interest expense).*

LOS 21.g: Compare the FCFE model and dividend discount models.

The free cash flow to equity approach takes a control perspective that assumes that recognition of value should be immediate. Dividend discount models take a minority perspective, under which value may not be realized until the dividend policy accurately reflects the firm's long-run profitability.

LOS 21.h: Evaluate the use of net income and EBITDA as proxies for cash flow in valuation.

Net income is a poor proxy for FCFE. We can see that by simply examining the formula for FCFE in terms of NI.

Once again, we have not burdened you with the derivation:

$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{net borrowing}$$

Net income includes noncash charges like depreciation that have to be added back to arrive at FCFE. In addition, it ignores cash flows that don't appear on the income statement, such as investments in working capital and fixed assets as well as net borrowings.

EBITDA is a poor proxy for FCFF. We can also see this from the formula relating FCFF to EBITDA (which you've already seen):

$$\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{Dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

EBITDA doesn't reflect the cash taxes paid by the firm, and it ignores the cash flow effects of the investments in working capital and fixed capital.

LOS 21.i: Explain the use of sensitivity analysis in FCFF and FCFE valuations.

Sensitivity analysis shows how sensitive an analyst's valuation results are to changes in each of a model's inputs. Some variables have a greater impact on valuation results than others. The importance of various forecasting errors can be assessed through comprehensive sensitivity analysis.

PROFESSOR'S NOTE

On the exam, it is unlikely that you will be asked to conduct a comprehensive sensitivity analysis that includes numerous calculations. However, a few key calculations and/or an interpretation of a sensitivity analysis are quite possible.

There are two major sources of error in valuation analysis:

- Estimating the future *growth* in FCFF and FCFE. Growth forecasts depend on a firm's future profitability, which in turn depends on sales growth, changes in profit margin, position in the life cycle, its competitive strategy, and the overall profitability of the industry.
- The chosen *base years* for the FCFF or FCFE growth forecasts. A representative base year must be chosen, or all of the subsequent analysis and valuation will be flawed.

For example, suppose an analyst is conducting a sensitivity analysis on the value of a beverage stock using the FCFE approach. She provides high and low estimates of the following variables consistent with their forecasted ranges in her model: FCFE, beta, risk-free rate of return, equity risk premium, and the FCFE growth rate. This produces a series of value estimates that reveal the sensitivity of her valuation estimate to variations in her underlying inputs.

LOS 21.j: Explain the single-stage (stable-growth), two-stage, and three-stage FCFF and FCFE models and justify the selection of the appropriate model given a company's characteristics.

Single-Stage FCFF Model

The **single-stage FCFF model** is analogous to the Gordon growth model discussed in the previous topic review on dividend valuation models. The single-stage FCFF model is useful for stable firms in mature industries. The model assumes that (1) FCFF grows at a constant rate (g) forever, and (2) the growth rate is less than the weighted average cost of capital (WACC).

The formula should look familiar; it's the Gordon growth model with FCFF replacing dividends and WACC replacing required return on equity.

$$\text{value of the firm} = \frac{FCFF_1}{WACC - g} = \frac{FCFF_0 \times (1 + g)}{WACC - g}$$

where:

$FCFF_1$ = expected free cash flow to the firm in one year

$FCFF_0$ = starting level of FCFF

g = constant expected growth rate in FCFF

WACC = weighted average cost of capital

The WACC is the weighted average of the rates of return required by each of the capital suppliers (usually just equity and debt) where the weights are the proportions of the firm's total market value from each capital source:

$$WACC = (w_e \times r_e) + [w_d \times r_d \times (1 - \text{tax rate})]$$

where:

$$w_e = \frac{\text{market value of equity}}{\text{market value of equity} + \text{market value of debt}}$$

$$w_d = \frac{\text{market value of debt}}{\text{market value of equity} + \text{market value of debt}}$$

It is assumed that payments to stockholders are *not* tax deductible, and payments to debtholders are tax deductible. Thus, the after-tax cost of debt is the before-tax rate of return on debt multiplied by one minus the firm's marginal tax rate. WACC will change over time as the firm's capital structure changes. Therefore, analysts usually use target capital structure weights rather than actual weights. On the exam, use target weights if they are given in the problem; otherwise use actual market-value weights.

Single-Stage FCFE Model

The single-stage constant-growth FCFE valuation model is analogous to the single-stage FCFF model, with FCFE instead of FCFF and required return on equity instead of WACC:

$$\text{value of equity} = \frac{FCFE_1}{r - g} = \frac{FCFE_0 \times (1 + g)}{r - g}$$

where:

$FCFE_1$ = expected free cash flow to equity in one year

$FCFE_0$ = starting level of FCFE

g = constant expected growth rate in FCFE

r = required return on equity

PROFESSOR'S NOTE

It's quite likely that a firm's growth rate in FCFF will be different than its FCFE growth rate.

The single-stage FCFE model is often used in international valuation, especially for companies in countries with high inflationary expectations when estimation of nominal growth rates and required returns is difficult. In those cases, real (i.e., inflation-adjusted) values are estimated for the inputs to the single-stage FCFE model: FCFE, the growth rate, and the required return.

Multistage Models: How Many Variations Are There?

This is where things get a little complicated. If we analyze every possible permutation of multistage free cash flow models that might appear on the exam, you would be overwhelmed. There are at least three important ways that these models can differ. Let's take them one at a time, but keep in mind the basic valuation principle at work here: *value is always estimated as the present value of the expected future cash flows discounted at the appropriate discount rate*.

FCFF versus FCFE: Remember that the value of the firm is the present value of the FCFF discounted at the WACC; the value of equity is the present value of the FCFE discounted at the required return on equity.

Two-stage versus three-stage models: We can model the future growth pattern in two stages or three. There are several variations of each approach depending on how we model growth within the stages.

Forecasting growth in total free cash flow (FCFF or FCFE) versus forecasting the growth rates in the components of free cash flow: The simple free cash flow model, in which we forecast total FCFE or FCFF, looks a lot like the multistage dividend discount models. The benefit of using free cash flow models, however, is when we refine our approach by forecasting the values and/or growth rates in the components of free cash flow over the first stage and then calculate free cash flow in each year using one of our formulas. There are even variations of this approach in which we start with earnings per share instead of sales.

Model Assumptions and Firm Characteristics

The assumptions for the two- and three-stage free cash flow models are simply the assumptions we make about the projected pattern of growth in free cash flow. We would use a two-stage model for a firm with two stages of growth: a short-term supernormal growth phase and a long-term stable growth phase. For example, a firm with a valuable patent that expires in seven years might experience a high growth rate for seven years and then immediately drop to a long-term, lower growth rate beginning in the eighth year. We would use a three-stage model for a firm that we expect to have three distinct stages of growth (e.g., a growth phase, a mature phase, and a transition phase).

Examples of Two-Stage FCFF and FCFE Models

Let's discuss some examples of two-stage models. We're going to wait until the next LOS, however, to start doing the number crunching. For now, concentrate on the differences in the assumptions: FCFF versus FCFE, growth pattern in the first stage, and forecasting total free cash flow versus forecasting its components.

We could analyze a:

- Two-stage FCFF model in which FCFF is projected to grow at 20% for the first four years and then 4% every year thereafter.
- Two-stage FCFE model in which FCFE declines from 20% to 4% over four years and then stays at 4% forever.
- Two-stage FCFE model in which sales grow at 20% for four years, the net profit margin is constant at 8%, fixed capital investment is equal to 60% of the dollar increase in sales, working capital investment is equal to 25% of the dollar increase in sales, and the debt ratio is 50%. Given a starting value for sales, we have all we need to forecast FCFE for the first four years.

Remember that we also need a terminal value at the end of the first growth stage for each of these examples. The most common method for estimating terminal value is to apply a single-stage free cash flow model at the point in time when growth settles down to its long-run level. This is the same method we used in the last topic review with dividend discount models.

Examples of Three-Stage FCFF and FCFE Models

Three-stage models have all the complications of the two-stage models, with an additional growth stage to consider. Keep in mind, however, that what we're trying to do is forecast FCFF or FCFE over some interim period with three distinct stages of growth, estimate the terminal value, and then estimate the value of the firm or the value of the equity today as the present value of those cash flows discounted at the appropriate required return. For example, we could analyze a:

- Three-stage FCFE model in which FCFE grows at 30% for two years (Stage 1), 15% for four years (Stage 2), and then 5% forever (Stage 3).
- Three-stage FCFF model in which FCFF grows at 25% for three years (Stage 1), declines to 4% over next the five years (Stage 2), then stays at 4% forever (Stage 3).
- Three-stage FCFE model in which we forecast the components of FCFE over three different stages.

LOS 21.k: Estimate a company's value using the appropriate free cash flow model(s).

We've already discussed free cash flow models, so now let's get to the hard work: actually calculating value using these models. We won't go through every different possible example, but we will give you a range of examples that cover nearly every important concept.

Single-Stage FCFF Model

The first example is a basic single-stage FCFF model where we first calculate WACC as the appropriate required return.

> **EXAMPLE: Calculating firm value with a single-stage FCFF model**
>
> Knappa Valley Winery's (KVW) most recent FCFF is $5,000,000. KVW's target debt-to-equity ratio is 0.25. The market value of the firm's debt is $10,000,000, and

KVW has 2,000,000 shares of common stock outstanding. The firm's tax rate is 40%, the shareholders require a return of 16% on their investment, the firm's before-tax cost of debt is 8%, and the expected long-term growth rate in FCFF is 5%. Calculate the value of the firm and the value per share of the equity.

Answer:

Note that the problem gives the FCFF in the most recent year ($FCFF_0$). Therefore, you need to increase $FCFF_0$ at the growth rate by one year (at the 5% rate) to get $FCFF_1$.

Let's calculate the WACC. The target debt-to-equity ratio is 0.25. This implies that for every $1 of debt, there is $4 of equity, for total capital of $5. Since total assets equals total capital, it follows that the target debt-to-asset ratio is 1/5, or 20%, and the target equity-to-asset ratio is 4/5, or 80%. The WACC is:

$$\text{WACC} = (w_e \times r_e) + [w_d \times r_d \times (1 - \text{tax rate})]$$

$$= (0.8 \times 0.16) + [0.20 \times 0.08(1 - 0.40)] = 0.1376 = 13.76\%$$

We can now calculate the value of the firm as:

$$\text{value of firm} = \frac{\$5{,}000{,}000 \times 1.050}{0.1376 - 0.050} = \$59{,}931{,}507$$

Given that debt is worth $10,000,000, the implied total value of the equity is:

$$\text{value of equity} = \$59{,}931{,}507 - \$10{,}000{,}000 = \$49{,}931{,}507$$

With 2,000,000 shares outstanding, the value of the equity per share is:

$$\frac{\$49{,}931{,}507}{2{,}000{,}000} = \$24.97$$

Notice that the actual debt-to-equity ratio (10,000,000 / 49,931,507 = 0.20) does not equal the target ratio of 0.25. There is nothing inconsistent in this example. WACC is usually calculated using target capital weights.

Single-Stage FCFE Model

EXAMPLE: Calculating value with a single-stage FCFE model

Ridgeway Construction has an FCFE of 2.50 Canadian dollars (C$) per share and is currently operating at a target debt-to-equity ratio of 0.4. The expected return on the market is 9%, the risk-free rate is 4%, and Ridgeway has a beta of 1.5. The expected growth rate of FCFE is 4.5%. Calculate the value of Ridgeway stock.

Answer:

Begin by computing the required return on equity with the CAPM:

$$r = 0.04 + [1.50 \times (0.09 - 0.04)] = 0.115 = 11.5\%$$

Note that the problem gives FCFE in the most recent year ($FCFE_0$). The model calls for the FCFE *next* year, which is $FCFE_1$. Therefore, you need to multiply $FCFE_0$ by one plus the growth rate to get $FCFE_1$. The equity value per share is:

$$\text{equity value per share} = \frac{C\$2.50 \times 1.045}{0.115 - 0.045} = C\$37.32$$

PROFESSOR'S NOTE

In the first example, we calculated total value and then equity value per share by dividing total value by the number of shares. In the second example we were given FCFE per share, so we could calculate value per share directly. Read the questions on the exam carefully to make sure you use the correct approach given the information in the problem.

Two-Stage FCFF Model

The first two-stage example requires the FCFF model and a forecast of the components of FCFF during the high-growth stage.

EXAMPLE: Calculating value with a two-stage FCFF model

The Prentice Paint Company earned a net profit margin of 20% on revenues of $20 million this year. Fixed capital investment was $2 million, and depreciation was $3 million. Working capital investment equals 7.5% of sales every year. Net income, fixed capital investment, depreciation, interest expense, and sales are expected to grow at 10% per year for the next five years. After five years, the growth in sales, net income, fixed capital investment, depreciation, and interest expense will decline to a stable 5% per year. The tax rate is 40%, and Prentice has 1 million shares of common stock outstanding and long-term debt paying 12.5% interest trading at its par value of $32 million. Calculate the value of the firm and its equity using the FCFF model if the WACC is 17% during the high-growth stage and 15% during the stable stage.

Answer:

The components of FCFF are calculated in the following table.

FCFF for Years 0 Through 6 (in per-share amounts of $)

	0	1	2	3	4	5	6
Sales ($)	20.00	22.00	24.20	26.62	29.28	32.21	33.82
Net Income	4.00	4.40	4.84	5.32	5.86	6.44	6.76
Interest (1 − T)	2.40	2.64	2.90	3.19	3.51	3.87	4.06
Depreciation	3.00	3.30	3.63	3.99	4.39	4.83	5.07
FCInv	2.00	2.20	2.42	2.66	2.93	3.22	3.38
WCInv	1.50	1.65	1.82	2.00	2.20	2.42	2.54
FCFF	**$5.90**	**$6.49**	**$7.13**	**$7.84**	**$8.63**	**$9.50**	**$9.97**

Let's demonstrate the calculation of the FCFF in Year 0:

net income = $20.00 × 0.20 = $4.00
interest = $32.00 × 0.125 = $4.00
interest(1 − T) = $4.00 × (1 − 0.40) = $2.40
WCInv = $20.00 × 0.075 = $1.50
FCFF = $4.00 + $2.40 + $3.00 − $2.00 − $1.50 = $5.90

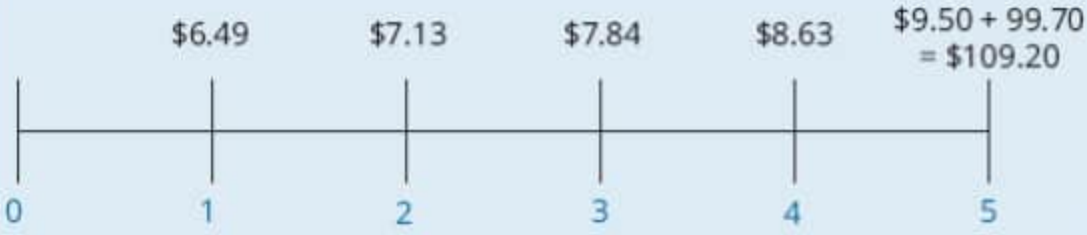
In Year 1, sales grow by 10% to $22.00 per share. Following five years of 10% growth, the growth of each component falls to 5%.

The terminal value (as of Year 5, discounted at the stable WACC of 15%) is:

$$\text{terminal value} = \frac{\text{FCFF}_6}{\text{WACC} - g} = \frac{\$9.97}{0.15 - 0.05} = \$99.70$$

We can place the cash flows to be evaluated on a time line, such as the one in the following figure, to get a clearer picture of what we need to evaluate.

FCFF Timeline



Notice that the WACC in the high-growth stage (17%) is different than the stable stage (15%).

We calculated terminal value in Year 5 using 15%, but we'll calculate the present value today of the high-growth cash flows and the terminal value at 17%. The total of the firm today is:

$$\text{value of firm} = \frac{\$6.49}{1.17^1} + \frac{\$7.13}{1.17^2} + \frac{\$7.84}{1.17^3} + \frac{\$8.63}{1.17^4} + \frac{\$109.20}{1.17^5} = \$70.06$$

To perform this calculation quickly and accurately, use the following keystrokes on your financial calculator:

CF0 = 0; C01 = 6.49; C02 = 7.13; C03 = 7.84; C04 = 8.63;
C05 = 109.20
I = 17; CPT → NPV = 70.06

Thus, given that the value of the firm's debt is $32 per share, the value of equity per share is $70.06 – $32.00 = $38.06.

It is uncommon for growth rates to drop as drastically and quickly from Stage 1 to Stage 2 as shown in the previous example. It is more likely to find a gradual decline in the growth rate as a company matures and attracts more competition that will decrease its profit margin and its sustainable growth rate. This next two-stage example is an FCFE model with declining growth rates in Stage 1 and constant growth in Stage 2.

EXAMPLE: Two-stage FCFE model with declining growth in Stage 1

Consider a rival to the Prentice Paint Company presented in the previous example. Suppose that Sioux Falls Decor also has revenues of $20 million this year. However, we assume that its future performance will be tracked relative to sales as follows:

- Sales growth and the net profit margin are projected by year as shown in the following table:

Sales and Net Margin Forecasts

Year	1	2	3	4	5	6
Sales growth	30%	25%	20%	15%	10%	5%
Net profit margin	8.0%	7.5%	7.0%	6.0%	5.5%	5.0%

- Fixed capital investment *net of depreciation* is projected to be 30% of the sales increase in each year.
- Working capital requirements are 7.0% of the projected dollar increase sales in each year.
- Debt will finance 40% of the investments in net capital and working capital.
- The company has a 12% required rate of return on equity.
- The firm has 1 million shares of common stock outstanding.

Calculate the value of the equity of Sioux Falls using the two-stage FCFE model.

Answer:

Recognize that the target debt-to-asset ratio (DR) is 0.40. The following table shows the FCFE for Years 1 through 6 ($ amounts are per share).

Calculating FCFE for Years 1 Through 6

Year	1	2	3	4	5	6
Sales growth	30%	25%	20%	15%	10%	5%
Net profit margin	8.0%	7.5%	7.0%	6.0%	5.5%	5.0%
Sales	$26.00	$32.50	$39.00	$44.85	$49.335	$51.802
Net income	2.08	2.44	2.73	2.691	2.71	2.59
FCInv − Dep	1.80	1.95	1.95	1.755	1.346	0.74
WCInv	0.42	0.455	0.455	0.4095	0.314	0.171
Debt financing*	0.888	0.962	0.962	0.864	0.664	0.364
FCFE	$0.748	$0.997	$1.287	$1.391	$1.714	$2.043

* Debt will finance 40% of the investment in net capital and working capital.

debt financing = (debt-to-asset ratio) × [(FCInv − Dep) + WCInv]

So for Year 3:

debt financing = (0.4) × [(1.95) + 0.455] = 0.962

Let's demonstrate the calculation of the cash flow components in Year 1:

$$\begin{aligned}
\text{sales} &= \$20.00 \times 1.30 = \$26.00 \\
\text{net income} &= \$26.00 \times 0.08 = \$2.08 \\
\text{net FCInv} &= (\$26.00 - \$20.00) \times 0.30 = \$1.80 \\
\text{WCInv} &= (\$26.00 - \$20.00) \times 0.07 = \$0.42 \\
\text{FCFE} &= \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{Dep})] - [(1 - \text{DR}) \times \text{WCInv}] \\
&= \$2.08 - [(1 - 0.4) \times \$1.80] - [(1 - 0.4) \times \$0.42] = \$0.748
\end{aligned}$$

Terminal value (as of Year 5, assuming 5% stable long-term growth) is equal to:

$$\text{terminal value} = \frac{\$2.043}{0.12 - 0.05} = \$29.186$$

Total current value of equity:

$$\begin{aligned}
\text{value of equity} &= \frac{\$0.748}{1.12^1} + \frac{\$0.997}{1.12^2} + \frac{\$1.287}{1.12^3} + \frac{\$1.391}{1.12^4} + \frac{\$1.714 + \$29.186}{1.12^5} \\
&= \$20.80
\end{aligned}$$

As usual, we would rely on the cash flow keys of our financial calculator to perform the previous calculation:

CF0 = 0; C01 = 0.748; C02 = 0.997; C03 = 1.287; C04 = 1.391;
C05 = 30.90

I = 12; CPT → NPV = 20.80

Three-Stage FCFE Model

The following example of a three-stage FCFE model is a little different than the last two examples because we're given growth in total FCFE in each of three stages, rather than the growth rates in the components. Growth in the first and third stage is constant, while growth in the second stage is declining. There is one tricky feature to this problem—the required return in each of the three growth stages is different.

EXAMPLE: Three-stage FCFE model with forecast growth in total FCFE

Medina Classic Furniture, Inc., is expected to experience growth in three distinct stages in the future. Its most recent FCFE is 0.90 Canadian dollars (C$) per share. The following information has been compiled:

High-growth period:

- Duration = 3 years.
- FCFE growth rate = 30%.
- Shareholders' required return = 20%.

Transitional period:

- Duration = 3 years.
- FCFE growth will decline by 9% per year down to the indicated stable growth rate.
- Shareholders' required return = 15%.

Stable-growth period:

- FCFE growth rate = 3%.

- Shareholders' required return = 10%.

Calculate the value of the firm's equity using the three-stage FCFE model.

Answer:

The annual FCFE and the associated present value are presented in the table:

FCFE and PV

High-Growth Period	Year 1	Year 2	Year 3
Growth rate	30%	30%	30%
FCFE	C$1.170	C$1.521	C$1.977
PV (@ 20%)	C$0.975	C$1.056	C$1.144

Transitional Period	Year 4	Year 5	Year 6
Growth rate	21%	12%	3%
FCFE	C$2.393	C$2.680	C$2.760
PV	C$1.204	C$1.173	C$1.050

The transitional present values are computed using a combination of the 20% initial discount rate and the transitional 15% rate. For example, the present value of $FCFE_5$ is computed as:

$$\text{C\$1.173} = \frac{\text{C\$2.680}}{1.20^3 \times 1.15^2}$$

We can calculate the terminal value of the stock as of Year 6 using the FCFE projected for Year 7. Notice that we use the Stage 3 required return of 10%.

$$\text{terminal value} = \frac{\$2.760 \times 1.03}{0.10 - 0.03} = \$40.611$$

The value of Medina stock is:

$$\text{value per share} = 0.975 + 1.056 + 1.144 + 1.204 + 1.173 + 1.050 + \left(\frac{40.611}{1.20^3 \times 1.15^3}\right) = \text{C\$22.055}$$

The changing discount rates were important here for a couple of reasons. First, the terminal value in Year 6 had to be discounted for three years at 20% and for three years at 15%. Second, due to the changing discount rates, our financial calculator was not as helpful as it was in other multiple cash flow calculations. It simply cannot handle the changing discount rates in one easy set of calculations.

LOS 21.l: Describe approaches for calculating the terminal value in a multistage valuation model.

There are two basic approaches for calculating terminal value: using a single-stage model or a multiple approach. All of our examples used the first approach, in which we forecasted an FCFF or FCFE at the point in time at which cash flows begin to grow at the long-term, stable growth rate, and then we estimated terminal value using a single-stage model.

The other way to do this is to use valuation multiples (like P/E ratios) to estimate terminal value. The terminal value in year *n* in terms of P/E, for example, would be expressed as:

terminal value in year *n* = (trailing P/E) × (earnings in year n)
terminal value in year *n* = (leading P/E) × (forecasted earnings in year n + 1)

EXAMPLE: Estimating terminal value with a P/E multiple

An analyst estimates the EPS of Polar Technology in five years to be $2.10, the EPS in six years to be $2.32, and the median trailing industry P/E to be 35. Calculate the terminal value in Year 5.

Answer:

terminal value in Year 5 = 35 × $2.10 = $73.50

LOS 21.m: Evaluate whether a stock is overvalued, fairly valued, or undervalued based on a free cash flow valuation model.

If a stock is trading at a price (market price) higher than the price implied by a free cash flow valuation model (model price), the stock is considered to be **overvalued**. Similarly, if the market price is lower than the model price, the stock is considered to be **undervalued**, and if the model price is equal to the market price, the stock is considered to be **fairly valued**.

MODULE QUIZ 21.5

1. The Gray Furniture Co. earned £3.50 per share last year. Investment in fixed capital was £2.00 per share, depreciation was £1.60, and the investment in working capital was £0.50 per share. Gray is currently operating at its target debt-to-asset ratio of 40%. Thus, 40% of annual investments in working capital and fixed capital will be financed with new borrowings. Shareholders require a return of 14% on their investment, and the expected growth rate is 4%. The value of Gray's stock is *closest* to:
   A. £27.04.
   B. £29.90.
   C. £30.78.

Use the following information to answer Questions 2 through 4.

The Sanford Software Co. earned $20 million before interest and taxes on revenues of $60 million last year. Investment in fixed capital was $12 million, and depreciation was $8 million. Working capital investment was $3 million. Sanford expects earnings before interest and taxes (EBIT), investment in fixed and working capital, depreciation, and sales to grow at 12% per year for the next five years. After five years, the growth in sales, EBIT, and working capital investment will decline to a stable 4% per year, and investments in fixed capital and depreciation will offset each

other. Sanford's tax rate is 40%. Suppose that the weighted average cost of capital (WACC) is 11% during the high growth stage and 8% during the stable stage. The calculation of FCFF in Years 1 through 5 is shown in the following table:

Year	0	1	2	3	4	5
Sales	60.00	67.20	75.26	84.30	94.41	105.74
EBIT	20.00	22.40	25.09	28.10	31.47	35.25
EBIT(1 – T)	12.00	13.44	15.05	16.86	18.88	21.15
Dep	8.00	8.96	10.04	11.24	12.59	14.10
FCInv	12.00	13.44	15.05	16.86	18.88	21.15
WCInv	3.00	3.36	3.76	4.21	4.72	5.29
FCFF	5.00	5.60	6.28	7.03	7.87	8.81

2. Free cash flow to the firm (FCFF) in Year 6 is *closest* to:
   A. $14.14.
   B. $16.49.
   C. $18.26.
3. The terminal value in Year 5 is *closest* to:
   A. $206.12.
   B. $220.25.
   C. $412.25.
4. The value of the firm using a FCFF model is *closest* to:
   A. $149.04.
   B. $265.17.
   C. $270.35.

Use the following information to answer Questions 5 through 9.

An analyst following Barlow Energy has compiled the following information in preparation for additional analysis she has to include in a report she has been asked to produce (data is in hundreds of millions of $):

Security Type	Market Value	Before-Tax Required Return
Preferred stock	$200	7.0%
Bonds	$600	7.5%
Common stock	$700	14.0%
Total	$1,500	

- Bonds are trading at par
- Preferred share dividends: $14
- Net income available to common: $125
- Investment in working capital: $30
- Investment in fixed capital: $100
- Net new borrowing: $40
- Depreciation: $50
- Tax rate: 40%
- Long-term growth rate of FCFF: 4%
- Long-term growth rate of FCFE: 4%

- WACC: 9.27%

5. The current FCFF for Barlow Energy is *closest* to:
   A. $36.
   B. $62.
   C. $86.
6. The total value of Barlow Energy using a single-stage FCFF model is *closest* to:
   A. $894.40.
   B. $1,631.88.
   C. $1,697.15.
7. The value of Barlow Energy's equity using a single-stage FCFF model is *closest* to:
   A. $897.15.
   B. $1,097.15.
   C. $1,497.15.
8. The current FCFE using the information for Barlow Energy is *closest* to:
   A. $45.
   B. $85.
   C. $99.
9. The value of Barlow Energy's equity using a single-stage model and the current FCFE is *closest* to:
   A. $468.
   B. $850.
   C. $884.
10. Which of the following is the *best* estimate of the cash flows available to the firm's investors before any financing decisions?
    A. EBITDA × (1 − tax rate).
    B. EBITDA × (1 − tax rate) + (Dep × tax rate) − FCInv − WCInv.
    C. EBITDA × (1 − tax rate) + (Dep × tax rate) − FCInv − WCInv + Int × (1 − tax rate).

Use the following information to answer Questions 11 and 12.

Rachel Keimmel, CFA, is researching the MWC Corporation, a U.S.-based automobile parts manufacturing firm. MWC has recently entered into a long-term agreement with a German automobile company to be the sole supplier of an innovative suspension system that will be used with a newly designed, moderately priced sports car. Keimmel believes that this new agreement will favorably impact MWC's stock price. To support her belief, Keimmel reviewed MWC's financial statements and sales forecasts and reached the following conclusions:

- MWC's earnings and FCFE growth will be 15% per year for two years, then stabilize at 8% per year.
- MWC will maintain its current dividend payout ratio.
- MWC has a beta of 1.2.
- Government bonds yield 6.4%, and the market equity risk premium is 5.5%.
- The most recent dividend paid to MWC shareholders was $2.30.

Keimmel also has MWC's current cash flow statement, which follows.

MWC Incorporated
Statement of Cash Flows, December 31, 2023
($ Thousands)

Cash Flow from Operating Activities		
Net income		29,960
Depreciation		8,400
Changes in Working Capital		
(Increase) Decrease in receivables	(4,000)	
(Increase) Decrease in inventories	(6,400)	
Increase (Decrease) in payables	4,800	
Increase (Decrease) in other current liabilities	1,200	
Net change in working capital		(4,400)
Net cash from operating activities		33,960
Cash Flow from Investing Activities		
Purchase of fixed assets (PP&E)	(12,000)	
Net cash from investing activities		(12,000)
Cash Flow from Financing Activities		
Change in debt outstanding	3,200	
Payment of cash dividends	(23,920)	
Net cash from financing activities		(20,720)
Net change in cash and cash equivalents		1,240
Beginning-of-period cash		8,760
End-of-period cash		10,000

11. The value of MWC's common stock using the two-stage dividend discount model is *closest* to:
    A. $56.33.
    B. $61.55.
    C. $65.88.

12. The value of MWC's common stock using the two-stage FCFE approach is *closest* to:
    A. $55.09.
    B. $59.10.
    C. $68.24.

13. The Hoffman Card Co. earned £1.50 per share last year. Investment in fixed capital was £0.80 per share, and depreciation was £0.30. Investment in working capital was £0.20 per share. Hoffman expects earnings to grow at 15% per year for the next five years, and that investment in fixed capital, depreciation, and investment in working capital will grow at the same rate. After five years, the growth in earnings and working capital requirements will decline to a stable 5%

per year, and investment in fixed capital and depreciation will offset each other (i.e., they will be equal). Hoffman's target debt ratio is 30%. The shareholders require a return of 17% on their investment during the high-growth stage, and a return of 10% on their investment during the stable stage. The FCFE in Year 6 and the value per share of Hoffman's common stock are *closest* to:

	FCFE in Year 6	Share value
A.	£2.88	£31.08
B.	£2.88	£57.60
C.	£2.03	£57.60

14. Suppose an analyst estimates equity value by discounting free cash flow to equity (FCFE) at the weighted average cost of capital (WACC) in the FCFE model and estimates firm and equity value by discounting free cash flow to the firm (FCFF) at the required return on equity in the FCFF model. The analyst would *most likely*:
    A. overestimate equity value with the FCFE model and underestimate firm value and equity value with the FCFF model.
    B. underestimate equity value with the FCFE model and overestimate firm value and equity value with the FCFF model.
    C. underestimate equity value with the FCFE model and underestimate firm value and equity value with the FCFF model.

Use the following information to answer Questions 15 and 16.

At the end of 2023, Meyer Henderson, CFA, also prepared a 10-year forecast of free cash flow to equity (FCFE) and free cash flow to the firm (FCFF) from 2024 to 2033 for Trammel Medical Supplies. In early 2024, Trammel unexpectedly announced a new 15-year issue of senior debt. The proceeds are expected to be used to repurchase common stock in the open market during 2024.

15. As a result of the unexpected debt issue, Henderson should *most likely*:
    A. increase his FCFE forecast for 2024 and decrease his FCFE forecast for 2025 through 2033.
    B. decrease his FCFE forecast for 2024 and increase his FCFE forecast for 2025 through 2033.
    C. increase his FCFE forecast for 2024 and not change his FCFE forecast for 2025 through 2033.
16. As a result of the unexpected debt issue, Henderson should *most likely*:
    A. increase his FCFF forecast for 2024 and decrease his FCFF forecast for 2025 through 2033.
    B. decrease his FCFF forecast for 2024 and increase his FCFF forecast for 2025 through 2033.
    C. not change his FCFF forecast for 2024 and also not change his FCFF forecast for 2025 through 2033.
17. The Anderson Door Co. earned C$30 million before interest and taxes on revenues of C$80 million last year. Capital expenditures were C$20 million, and depreciation was C$15 million. The additions to working capital were C$6 million. The firm's weighted average cost of capital is 12.45%, the marginal tax rate is 40%, and the expected cash flow growth is 5%. The market value of debt is C$25 million. The value of the firm's equity is *closest* to:
    A. C$73.70.
    B. C$93.96.
    C. C$98.70.

KEY CONCEPTS

LOS 21.a

FCFF is the cash available to all of the firm's investors, including stockholders and bondholders, after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investments. FCFE is the cash available to common shareholders after funding capital requirements, working capital needs, and debt financing requirements.

The value of the firm is the present value of the expected future FCFF discounted at the WACC. The value of the firm's equity is the present value of the expected future FCFE discounted at the required return on equity.

FCFE is easier and more straightforward to use in cases where the company's capital structure is not particularly volatile. On the other hand, if a company has negative FCFE and significant debt outstanding, FCFF is generally the best choice.

LOS 21.b

Analysts prefer to use either FCFF or FCFE as a measure of value if:

- The firm does not pay dividends.
- The firm pays dividends, but the dividends do not reflect the company's long-run profitability.
- The analyst takes a control perspective.

Thus, in valuation, the use of free cash flows reflects a control perspective while the use of dividends reflects a minority common stockholder's perspective. The ownership perspective in the free cash flow approach is that of an acquirer who can change the firm's dividend policy, which is a control perspective.

LOS 21.c, 21.d

FCFF and FCFE may be calculated starting either from net income, cash flows from operations, EBIT, or EBITDA. You need to know how to calculate the following measures using financial data:

FCFF = NI + NCC + [Int × (1 − tax rate)] − FCInv − WCInv
FCFF = [EBIT × (1 − tax rate)] + Dep − FCInv − WCInv
FCFF = [EBITDA × (1 − tax rate)] + (Dep × tax rate) − FCInv − WCInv
FCFF = CFO + [Int × (1 − tax rate)] − FCInv
FCFE = FCFF − [Int × (1 − tax rate)] + net borrowing
FCFE = NI + NCC − FCInv − WCInv + net borrowing
FCFE = CFO − FCInv + net borrowing

LOS 21.e

For forecasting FCFE, use:

FCFE = NI − [(1 − DR) × (FCInv − Dep)] − [(1 − DR) × WCInv]

LOS 21.f

Dividends, share repurchases, and share issues have no effect on FCFF and FCFE; changes in leverage have only a minor effect on FCFE and no effect on FCFF.

LOS 21.g

The free cash flow to equity approach takes a control perspective, which assumes that recognition of value should be immediate. Dividend discount models take a

minority perspective, under which value may not be realized until the dividend policy accurately reflects the firm's long-run profitability.

LOS 21.h

Net income is a poor proxy for FCFE. Net income includes noncash charges (e.g., depreciation) that have to be added back to arrive at FCFE. In addition, it ignores cash flows that don't appear on the income statement, such as investments in working capital and fixed assets as well as net borrowings. This can be seen by simply examining the formula for FCFE in terms of NI:

FCFE = NI + NCC − FCInv − WCInv + net borrowing

EBITDA is a poor proxy for FCFF. The following equation makes this point clear:

FCFF = EBITDA (1 − tax rate) + (Dep × tax rate) − FCInv − WCInv

EBITDA doesn't reflect the cash taxes paid by the firm, and it ignores the cash flow effects of the investments in working capital and fixed capital.

LOS 21.i

Sensitivity analysis shows how sensitive an analyst's valuation results are to changes in each of a model's inputs. Some variables have a greater impact on valuation results than others. The importance of various forecasting errors can be assessed through comprehensive sensitivity analysis.

LOS 21.j, 21.k

The single-stage free cash flow model are useful for stable firms in mature industries. The models assume free cash flows grow at a constant rate, g, forever and that the growth rate is less than the required return (WACC for FCFF models and required return on equity for FCFE models).

$$\text{value of the firm} = \frac{\text{FCFF}_1}{\text{WACC} - g}$$

$$\text{value of equity} = \frac{\text{FCFE}_1}{r - g}$$

The assumptions for the two- and three-stage free cash flow models are simply the assumptions we make about the projected pattern of growth in free cash flow. We'd use a two-stage model for a firm with two stages of growth: a short-term supernormal growth phase and a long-term stable growth phase. We'd use a three-stage model for a firm that we expect to have three distinct stages of growth (e.g., a growth phase, a mature phase, and a transition phase).

LOS 21.l

There are two basic approaches for calculating terminal value: using a single-stage model or a multiple approach. The multiple approach uses valuation multiples (like P/E ratios) to estimate terminal value.

LOS 21.m

If a stock's model price is lower than (higher than, equal to) the market price, the stock is considered overvalued (undervalued, fairly valued).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 21.1

1. **C** Dividend discount models like the Gordon growth model and the dividend discount H-model are not appropriate in this case for two reasons: (1) dividends are not related to the firm's earnings stream, and (2) this is a takeover situation in which a free cash flow model is more appropriate.

   The FCFF model is preferred to the FCFE model because (1) FCFE is negative and volatile and (2) leverage is relatively high. (LOS 21.a)

2. **A** Although the calculation is a bit unusual (we usually calculate firm value as the present value of FCFF discounted at the weighted average cost of capital), the analyst has correctly calculated firm value. The first term is equal to the market value of equity on 12/31/2023; firm value is equal to the market value of equity plus the market value of debt. (LOS 21.a)

Module Quiz 21.2, 21.3

For Questions 1 through 3, Items #1, 2, 4, 5, 6, and 7 were applied correctly. Only Item #3 related to the reversal of restructuring charges was applied incorrectly: income from restructuring charge reversals is a noncash gain that should be subtracted from net income to calculate FCFF. Depreciation and software amortization should be added back to net income, after-tax interest should be added back, and the increase in deferred taxes should be added back (because it is not expected to reverse in the foreseeable future). Net working capital and fixed capital investments should be subtracted from net income to arrive at FCFF. The correct calculation of FCFF is

$$\begin{aligned} FCFF_{2023} &= \$173 + \$23 - \$6 + \$17 + [\$19(1 - 0.35)] - \$86 - \$47 \\ &= \$86.35 \text{ million} \end{aligned}$$

1. **A** See answer explanation above for Questions 1 through 3. (Module 21.3, LOS 21.c)

2. **B** See answer explanation above for Questions 1 through 3. (Module 21.3, LOS 21.c)

3. **A** See answer explanation above for Questions 1 through 3. (Module 21.3, LOS 21.c)

4. **B** Given: NI = \$50; depreciation = \$27; ending net PP&E = ending gross fixed assets – ending accumulated depreciation = \$136 – \$40 = \$96; beginning net PP&E = beginning gross fixed assets – beginning accumulated depreciation = \$90 – \$30 = \$60; WCInv = \$4; net borrowings = \$0; gains on sale of equipment = \$8.

   FCInv = ending net PPE – beginning net PPE + depreciation – gain on sale = 96 – 60 + 27 – 8 = \$55

   NCC = depreciation – gain = 27 – 8 = \$19

   FCFE = NI + NCC – FCInv – WCInv + net borrowings = 50 + 19 – 55 – 4 + 0 = \$10

(Module 21.3, LOS 21.c)

5. **C** The firm must have interest expense on its income statement because of the debt on its balance sheet. By ignoring the after-tax interest cash flow, the analyst has understated FCFF, which is actually equal to CFO plus after-tax interest cash flow less fixed capital investment. He has, however, calculated FCFE correctly because FCFE is equal to CFO less fixed capital investment (his incorrect FCFF calculation) plus net borrowing. (Module 21.3, LOS 21.c)

Module Quiz 21.4

1. **B** Free cash flow to the firm is equal to cash flow from operations plus after-tax interest expense [interest(1 – tax rate)] minus fixed capital investment. (LOS 21.d)

Module Quiz 21.5

1. **C** $FCFE = NI - (1 - DR)(FCInv - Dep) - (1 - DR)(WCInv)$

$= £3.50 - [(1 - 0.4)(£2.00 - £1.60)] - [(1 - 0.4)(£0.50)] = £2.96$

$$\text{equity value per share} = \frac{£2.96 \times 1.04}{0.14 - 0.04} = £30.78$$

(LOS 21.e)

2. **B** The following table shows FCFF for Years 0 through 6 (in $):

Year	0	1	2	3	4	5	6
Sales	60.00	67.20	75.26	84.30	94.41	105.74	109.97
EBIT	20.00	22.40	25.09	28.10	31.47	35.25	36.66
EBIT(1 – T)	12.00	13.44	15.05	16.86	18.88	21.15	21.99
Dep	8.00	8.96	10.04	11.24	12.59	14.10	—
FCInv	12.00	13.44	15.05	16.86	18.88	21.15	—
WCInv	3.00	3.36	3.76	4.21	4.72	5.29	5.50
FCFF	5.00	5.60	6.28	7.03	7.87	8.81	16.49

$FCFF = [EBIT \times (1 - \text{tax rate})] + Dep - FCInv - WCInv$

$FCFF_6 = 21.99 + 0 + 0 - 5.50 = 16.49$

(LOS 21.c)

3. **C** The terminal value (as of Year 5) is found by using the FCFF in Year 6 and WACC of 8% and growth rate of 4% in the stable growth stage:

$$\text{terminal value}_5 = \frac{\$16.49}{0.08 - 0.04} = \$412.25$$

(LOS 21.k)

4. **C** The value of the firm today is the present value of the forecasted cash flows, discounted at the WACC during the high-growth stage of 11%:

$$\text{value of firm} = \frac{\$5.60}{1.11} + \frac{\$6.28}{1.11^2} + \frac{\$7.03}{1.11^3} + \frac{\$7.87}{1.11^4} + \frac{\$8.81 + \$412.25}{1.11^5}$$

$$= \$270.35$$

Using the TI BA II Plus™ calculator, enter $CF_0 = 0.00$; C01 = 5.60; C02 = 6.28; C03 = 7.03; C04 = 7.87; C05 = 8.81 + 412.25 = 421.06; I = 11; CPT → NPV = 270.35

(LOS 21.k)

5. **C** With the bonds trading at par, the interest expense is based on the before-tax yield:

interest = \$600 × 0.075 = \$45

Add back preferred dividends to net income available to common to get FCFF:

$$\text{FCFF} = \text{NI(available to common)} + \text{NCC} + [\text{Int} \times (1 - \text{tax rate})] + \text{preferred dividends} - \text{FCInv} - \text{WCInv}$$

$$\text{FCFF} = 125 + 50 + [45 \times (1 - 0.40)] + 14 - 100 - 30 = \$86$$

(LOS 21.c)

6. **C** The value of the firm is the present value of the constantly growing FCFF. Using single-stage FCFF model we get:

$$\text{value of firm} = \frac{\text{FCFF}_0 \times (1 + g)}{\text{WACC} - g} = \frac{\$86 \times 1.04}{0.0927 - 0.04} = \$1,697.15$$

(LOS 21.k)

7. **A** The value of the equity is equal to firm value less the market value of debt and preferred stock:

value of equity = \$1,697.15 – \$600 – \$200 = \$897.15

(LOS 21.k)

8. **B** FCFF = 86 (computed earlier).

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] - \text{preferred dividends} + \text{net borrowing}$$

$$= 86 - [45 \times (1 - 0.4)] - 14 + 40 = \$85$$

(LOS 21.c)

9. **C** $$\text{value of equity} = \frac{\$85 \times 1.04}{0.14 - 0.04} = \$884$$

(LOS 21.k)

10. **B** Free cash flow to the firm (FCFF) is the estimate of the cash flows available to the firm's investors after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investment decisions, but before the firm makes any financing decisions. EBITDA is a poor proxy for free cash flow. FCFF is calculated as:

FCFF = [EBITDA × (1 – tax rate)] + (Dep × tax rate) – FCInv – WCInv

(LOS 21.h)

11. **A** Based on the CAPM, the required return on MWC's common equity can be computed as follows:

$r = 6.4\% + (1.2 \times 5.5\%) = 13\%$

The current value of MWC common stock can be estimated using the two-stage DDM approach as follows:

$g = 15\%$

$D_{2023} = \$2.30$

$D_{2024} = \$2.30 \times 1.15 = \$2.65$

$D_{2025} = \$2.65 \times 1.15 = \$3.05$

$$\text{terminal value} = \frac{\$3.05 \times 1.08}{(0.13 - 0.08)} = \$65.88$$

$$\text{equity value} = \frac{\$2.65}{1.13} + \frac{\$3.05 + \$65.88}{1.13^2} = \$56.33$$

(LOS 21.k)

12. **B** The current value of MWC common stock can be estimated using the two-stage FCFE approach as follows:

$$FCFE_{2023} = CFO - FCInv + \text{net borrowing} = 33{,}960 - 12{,}000 + 3{,}200 = \$25{,}160$$

$$\text{shares outstanding} = \frac{\text{dividends paid}}{\text{dividends per share}} = \frac{\$23{,}920}{\$2.30} = 10{,}400$$

$$FCFE_{2023} \text{ per share} = \frac{FCFE_{2023}}{10{,}400} = \frac{\$25{,}160}{10{,}400} = \$2.42$$

$g = 15\%$

$FCFE_{2023} = \$2.42$

$FCFE_{2024} = \$2.42 \times 1.15 = \$2.78$

$FCFE_{2025} = \$2.78 \times 1.15 = \$3.20$

$$\text{terminal value} = \frac{\$3.20 \times 1.08}{(0.13 - 0.08)} = \$69.12$$

$$\text{equity value} = \frac{\$2.78}{1.13} + \frac{\$3.20 + \$69.12}{1.13^2} = \$59.10$$

(LOS 21.d)

13. **A** The following table shows FCFE for Years 0 through 6 (in £).

$$FCFE = NI - [(1 - DR) \times (FCInv - Dep)] - [(1 - DR) \times WCInv]$$

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
NI	1.50	1.73	1.98	2.28	2.62	3.02	3.17
(–) [(1 – DR) (FCInv – Dep)]	0.35	0.40	0.46	0.53	0.61	0.70	0
(–) [(1 – DR) (WCInv)]	0.14	0.16	0.19	0.21	0.24	0.28	0.29
(=) FCFE	1.01	1.17	1.33	1.53	1.76	2.03	2.88

Example of FCFE calculation (Year 1):

$$\begin{aligned} FCFE &= NI - [(1 - DR) \times (FCInv - Dep)] - [(1 - DR) \times WCInv] \\ &= 1.73 - [(1 - 0.3) \times (0.92 - 0.35)] - [(1 - 0.3) \times 0.23] \\ &= 1.17 \end{aligned}$$

Calculate terminal value in Year 5 using FCFE estimate for Year 6, discounted at required return of 10% in the stable growth period.

$$\text{terminal value}_5 = \frac{£2.88}{0.10 - 0.05} = £57.60$$

Use the short-term discount rate of 17% to discount the cash flows back to the present:

$$\text{equity value per share} = \frac{1.17}{1.17^1} + \frac{1.33}{1.17^2} + \frac{1.53}{1.17^3} + \frac{1.76}{1.17^4} + \frac{2.03 + 57.60}{1.17^5}$$

$$= £31.08$$

The keystrokes for a TI BA II Plus™ calculator are:

[CF] [2ND] [CLR WORK]

0 [ENTER] [↓]

1.17 [ENTER] [↓] [↓]

1.34 [ENTER] [↓] [↓]

1.54 [ENTER] [↓] [↓]

1.76 [ENTER] [↓] [↓]

59.63 [ENTER] [↓] [↓]

[NPV] 17 [ENTER] [↓] [CPT]

(LOS 21.k)

14. **A** WACC is less than required return on equity. Incorrectly using the WACC (which is too low) in the FCFE model will overestimate equity value. Incorrectly using required return on equity (which is too high) in the FCFF model will underestimate firm value and equity value. (LOS 21.k)

15. **A** The increased net borrowing for 2024 will cause the forecasted free cash flow to *equity* (FCFE) to increase in 2024. However, in future years, the higher interest expense associated with the debt issue will cause the FCFE forecast to decrease. (LOS 21.f)

16. **C** Free cash flow to the *firm* (FCFF) represents cash flow available to all investors before any financing cash flows, including interest payments. Changes in leverage are uses of cash (i.e., financing decisions) that do not affect FCFF. (LOS 21.f)

17. **A** $FCFF_0 = [EBIT \times (1 - \text{tax rate})] + Dep - FCInv - WCInv$

$FCFF_0$ (in millions) $= [C\$30 \times (1 - 0.40)] + C\$15 - C\$20 - C\$6 = C\$7.0$

$$\text{value of firm (in millions)} = \frac{C\$7.0 \times 1.05}{0.1245 - 0.05} = C\$98.7$$

value of equity (in millions) $= C\$98.7 - C\$25.0 = C\$73.7$

(LOS 21.k)

READING 22

MARKET-BASED VALUATION: PRICE AND ENTERPRISE VALUE MULTIPLES

EXAM FOCUS

This topic review covers the estimation of P/E, P/B, PEG, P/S, P/CF, and enterprise value/EBITDA ratios. The justified price multiple models draw heavily on the previous two topic reviews on dividend discount models and free cash flow models. You should be able to estimate justified price multiples for individual firms and to apply the method of comparables to estimate their (relative) values.

MODULE 22.1: P/E MULTIPLE

Video covering this content is available online.

PROFESSOR'S NOTE
The module videos for this topic review do not exactly correspond to the module content, for the ease of exposition and flow of material.

Warm-Up: Multiples

Price multiples are among the most widely used tools for valuation of equities. Comparing stocks' price multiples can help an investor judge whether a particular stock is overvalued, undervalued, or properly valued in terms of measures such as earnings, sales, cash flow, or book value per share. **Enterprise value multiples** relate the total value of a company, as reflected in the market value of its capital from all sources, to a measure of operating earnings generated, such as earnings before interest, taxes, depreciation, and amortization. **Momentum indicators** compare a stock's price or a company's earnings to their values in earlier periods.

LOS 22.a: Contrast the method of comparables and the method based on forecasted fundamentals as approaches to using price multiples in valuation and explain economic rationales for each approach.

The **method of comparables** values a stock based on the average price multiple of the stock of similar companies. The economic rationale for the method of comparables is the Law of One Price, which asserts that two similar assets should sell at comparable price multiples (e.g., price-to-earnings). This is a relative valuation method, so we can only assert that a stock is over- or undervalued *relative* to benchmark value.

The **method of forecasted fundamentals** values a stock based on the ratio of its value from a discounted cash flow (DCF) model to some fundamental variable (e.g., earnings per share). The economic rationale for the method of forecasted fundamentals is that the value used in the numerator of the justified price multiple is derived from a DCF model: value is equal to the present value of expected future cash flows discounted at the appropriate risk-adjusted rate of return.

EXAMPLE: Method of comparables

MK Technologies shares are selling for $50. Earnings for the last 12 months were $2 per share. The average trailing P/E ratio for firms in MK's industry is 32 times. Determine whether MK is over- or undervalued using the method of comparables.

Answer:

MK's trailing P/E is:

$$\frac{\$50}{\$2} = 25 \text{ times}$$

MK is relatively undervalued because its observed trailing P/E ratio (25 times) is less than the industry average trailing P/E ratio (32 times).

EXAMPLE: Method of forecasted fundamentals

Shares of Comtronics, Inc., are selling for $30. The mean analyst earnings per share forecast for next year is $4.00, and the long-run growth rate is 5%. Comtronics has a dividend payout ratio of 60%. The required return is 14%. Calculate the fundamental value of Comtronics using the Gordon growth model and determine whether Comtronics shares are over- or undervalued using the method of forecasted fundamentals.

Answer:

The fundamental value according to the Gordon growth model is:

$$V_0 = \frac{D_1}{r - g} = \frac{(0.6 \times \$4.00)}{0.14 - 0.05} = \$26.67$$

The fair value P/E ratio based on forecasted fundamentals is:

$$\frac{\$26.67}{\$4.00} = 6.67 \text{ times}$$

The observed leading P/E ratio based on the current market price is:

$$\frac{\$30.00}{\$4.00} = 7.50 \text{ times}$$

Comtronics is overvalued because the observed P/E multiple of 7.5 is greater than the fair value P/E ratio of 6.67. Notice that we would have come to the same conclusion by comparing market price ($30.00) to intrinsic value ($26.67).

LOS 22.b: Calculate and interpret a justified price multiple.

LOS 22.c: Describe rationales for and possible drawbacks to using alternative price multiples and dividend yield in valuation.

LOS 22.d: Calculate and interpret alternative price multiples and dividend yield.

Price multiples are ratios of a common stock's market price to some fundamental variable. The most common example is the price-to-earnings (P/E) ratio. A **justified price multiple** is what the multiple *should be* if the stock is fairly valued. If the actual multiple is greater than the justified price multiple, the stock is overvalued; if the actual multiple is less than the justified multiple, the stock is undervalued (all else equal).

P/E Ratio

There are a number of rationales for using price-to-earnings (P/E) ratio in valuation:

- Earnings power, as measured by earnings per share (EPS), is the primary determinant of investment value.
- The P/E ratio is popular in the investment community.
- Empirical research shows that P/E differences are significantly related to long-run average stock returns.

On the other hand, P/E ratios have a number of shortcomings:

- Earnings can be *negative*, which produces a meaningless P/E ratio.
- The volatile, transitory portion of earnings makes the interpretation of P/Es difficult for analysts.
- Management discretion within allowed accounting practices can distort reported earnings, and thereby lessen the comparability of P/Es across firms.

We can define two versions of the P/E ratio: trailing and leading P/E. The difference between the two is how earnings (the denominator) are calculated. *Trailing P/E* uses earnings over the *most recent* 12 months in the denominator. *Leading P/E ratio* (a.k.a. forward or prospective P/E) uses next year's expected earnings, which is defined as either expected earnings per share (EPS) for the next four quarters, or expected EPS for the next fiscal year.

$$\text{trailing P/E} = \frac{\text{market price per share}}{\text{EPS over previous 12 months}}$$

$$\text{leading P/E} = \frac{\text{market price per share}}{\text{forecasted EPS over next 12 months}}$$

Trailing P/E is not useful for forecasting and valuation if the firm's business has changed (e.g., as a result of an acquisition). Leading P/E may not be relevant if earnings are sufficiently volatile so that next year's earnings are not forecastable with any degree of accuracy.

> **EXAMPLE: Calculating P/E ratio**
>
> Byron Investments, Inc., reported €32 million in earnings during the current fiscal year. An analyst forecasts an EPS over the next 12 months of €1.00. Byron has 40 million shares outstanding at a market price of €18.00 per share. Calculate Byron's trailing and leading P/E ratios.
>
> **Answer:**

$$\text{current-year EPS} = \frac{€32{,}000{,}000}{40{,}000{,}000} = €0.80$$

$$\text{trailing P/E} = \frac{€18.00}{€0.80} = 22.5$$

$$\text{leading P/E} = \frac{€18.00}{€1.00} = 18.0$$

MODULE QUIZ 22.1

1. Consumer Products, Inc., has a trailing P/E of 27.52, while the median peer group P/E is 33.25. Assuming that there are no differences in the fundamentals among the peer firms and Consumer Products, it is *most likely* that the firm's stock:
   A. should be sold short.
   B. appears to be overvalued.
   C. appears to be undervalued.

2. A firm has a justified price-to-sales ratio of 2.0 times, a net profit margin of 5%, and a long-term growth rate of 4%. The justified leading P/E (based on the Gordon growth model) is *closest* to:
   A. 34.8.
   B. 38.5.
   C. 40.0.

3. At the end of 2023, an analyst estimates the value of Copyright, Inc., common stock to be $84 per share using a two-stage, dividend discount H-model and forecasts earnings for 2024 to be $4.20 per share. Copyright is *most likely*:
   A. underpriced if its actual leading P/E is 15.0 times.
   B. underpriced if its actual leading P/E is 23.0 times.
   C. overpriced if its actual leading P/E is 16.6 times.

MODULE 22.2: P/B MULTIPLE

Video covering this content is available online.

P/B Ratio

Advantages of using the price-to-book (P/B) ratio include:

- Book value is a cumulative amount that is usually positive, even when the firm reports a loss and EPS is negative. Thus, a P/B can typically be used when P/E cannot.
- Book value is more stable than EPS, so it may be more useful than P/E when EPS is particularly high, low, or volatile.
- Book value is an appropriate measure of net asset value for firms that primarily hold liquid assets. Examples include finance, investment, insurance, and banking firms.
- P/B can be useful in valuing companies that are expected to go out of business.
- Empirical research shows that P/Bs help explain differences in long-run average stock returns.

Disadvantages of using P/B include:

- P/Bs do not reflect the value of intangible economic assets, such as human capital.
- P/Bs can be misleading when there are significant differences in the asset size of the firms under consideration because in some cases the firm's business model dictates the size of its asset base. A firm that outsources its production will have fewer assets, lower book value, and a higher P/B ratio than an otherwise similar firm in the same industry that doesn't outsource.

- Different accounting conventions can obscure the true investment in the firm made by shareholders, which reduces the comparability of P/Bs across firms and countries. For example, research and development costs (R&D) are expensed in the United States, which can understate investment.
- Inflation and technological change can cause the book and market values of assets to differ significantly, so book value is not an accurate measure of the value of shareholders' investment. This makes it more difficult to compare P/Bs across firms.

The price-to-book ratio is defined as:

$$\text{P/B ratio} = \frac{\text{market value of equity}}{\text{book value of equity}} = \frac{\text{market price per share}}{\text{book value per share}}$$

where:

$$\begin{aligned}\text{book value of equity} &= \text{common shareholders' equity} \\ &= (\text{total assets} - \text{total liabilities}) - \text{preferred stock}\end{aligned}$$

We often make adjustments to book value to create more useful comparisons of P/B ratios across different stocks. A common adjustment is to use tangible book value, which is equal to book value of equity less intangible assets. Examples of intangible assets include goodwill from acquisitions (which makes sense because it is not really an asset) and patents (which is more questionable since the asset and patent are separable). Furthermore, balance sheets should be adjusted for significant off-balance-sheet assets and liabilities and for differences between the fair and recorded value of assets and liabilities. Finally, book values often need to be adjusted to ensure comparability. For example, companies using first in, first out (FIFO) for inventory valuation cannot be accurately compared with peers using last in, first out (LIFO). Thus, book values should be restated on a consistent basis.

EXAMPLE: Calculating P/B ratio

Based on the information in the following figure, calculate the P/B for Crisco Systems, Inc., and Soothsayer Corp. as of the end of 2023.

Data for Crisco Systems, Inc., and Soothsayer Corp.

Company	Book Value of Equity 2023 (millions of $)	Sales 2023 (millions of $)	Shares Outstanding 2023 (millions)	Price FYE 2023 ($)
Crisco Systems, Inc.	$28,039	$18,878	7,001	$17.83
Soothsayer Corp.	$6,320	$9,475	5,233	$12.15

Answer:

Crisco Systems, Inc.:

$$\text{book value per share} = \frac{\text{book value of equity}}{\text{number of shares outstanding}}$$

$$= \frac{\$28{,}039}{7{,}001} = \$4.01$$

$$\text{P/B} = \frac{\text{market price per share}}{\text{book value per share}} = \frac{\$17.83}{\$4.01} = 4.45 \text{ times}$$

Soothsayer Corp.:

$$\text{book value per share} = \frac{\text{book value of equity}}{\text{number of shares outstanding}}$$

$$= \frac{\$6{,}320}{5{,}233} = \$1.21$$

$$\text{P/B} = \frac{\text{market price per share}}{\text{book value per share}} = \frac{\$12.15}{\$1.21} = 10.04 \text{ times}$$

MODULE 22.3: P/S AND P/CF MULTIPLE

Video covering this content is available online.

P/S Ratio

The *advantages* of using the price-to-sales (P/S) ratio include:

- P/S is meaningful even for distressed firms since sales revenue is always positive. This is not the case for P/E and P/B ratios, which can be negative.
- Sales revenue is not as easy to manipulate or distort as EPS and book value, which are significantly affected by accounting conventions.
- P/S ratios are not as volatile as P/E multiples. This may make P/S ratios more reliable in valuation analysis when earnings for a particular year are very high or very low relative to the long-run average.
- P/S ratios are particularly appropriate for valuing stocks in mature or cyclical industries and start-up companies with no record of earnings. It is also often used to value investment management companies and partnerships.
- Like P/E and P/B ratios, empirical research finds that differences in P/S are significantly related to differences in long-run average stock returns.

The *disadvantages* of using P/S ratios include:

- High growth in sales does not necessarily indicate high operating profits as measured by earnings and cash flow.
- P/S ratios do not capture differences in cost structures across companies.
- While less subject to distortion, revenue recognition practices can still distort sales forecasts. For example, analysts should look for company practices that speed up revenue recognition. An example is sales on a bill-and-hold basis, which involves selling products and delivering them at a later date. This practice accelerates sales into an earlier reporting period and distorts the P/S ratio.

P/S multiples are computed by dividing a stock's price per share by sales or revenue per share, or by dividing the market value of the firm's equity by its total sales:

$$\text{P/S ratio} = \frac{\text{market value of equity}}{\text{total sales}} = \frac{\text{market price per share}}{\text{sales per share}}$$

EXAMPLE: Calculating P/S ratio

Based on the information in the following figure, calculate the current P/S for Crisco Systems, Inc., and Soothsayer Corp.

Data for Crisco Systems, Inc., and Soothsayer Corp.

Company	Book Value of Equity 2023 (millions of $)	Sales 2023 (millions of $)	Shares Outstanding 2023 (millions)	Price FYE 2023 ($)
Crisco Systems, Inc.	$28,039	$18,878	7,001	$17.83
Soothsayer Corp.	$6,320	$9,475	5,233	$12.15

Answer:

Crisco Systems, Inc.:

$$\text{sales per share} = \frac{\text{sales}}{\text{number of shares outstanding}}$$

$$= \frac{\$18{,}878 \text{ million}}{7{,}001 \text{ million}} = \$2.70$$

$$\text{P/S} = \frac{\text{market price per share}}{\text{sales per share}} = \frac{\$17.83}{\$2.70} = 6.60 \text{ times}$$

Soothsayer Corp.:

$$\text{sales per share} = \frac{\text{sales}}{\text{number of shares outstanding}}$$

$$= \frac{\$9{,}475 \text{ million}}{5{,}233 \text{ million}} = \$1.81$$

$$\text{P/S} = \frac{\text{market price per share}}{\text{sales per share}} = \frac{\$12.15}{\$1.81} = 6.71 \text{ times}$$

P/CF Ratio

Advantages of using the price-to-cash flow (P/CF) ratio include:

- Cash flow is harder for managers to manipulate than earnings.
- Price to cash flow is more stable than price to earnings.
- Reliance on cash flow rather than earnings handles the problem of differences in the quality of reported earnings, which is a problem for P/E.
- Empirical evidence indicates that differences in price to cash flow are significantly related to differences in long-run average stock returns.

There are two drawbacks to the price-to-cash flow ratio, both of which are related to the definition of cash flow. We discuss the specific cash flow definitions next.

- Items affecting actual cash flow from operations are ignored when the EPS plus noncash charges estimate is used. For example, noncash revenue and net changes in working capital are ignored.

- From a theoretical perspective, free cash flow to equity (FCFE) is preferable to operating cash flow. However, FCFE is more volatile than operating cash flow, so it is not necessarily more informative.

MODULE 22.4: EV AND OTHER ASPECTS

Video covering this content is available online.

Dividend Yield

The dividend yield (D/P) is the ratio of the common dividend to the market price. It is most often used for valuing indexes. *Advantages* of the dividend yield approach include:

- Dividend yield contributes to total investment return.
- Dividends are not as risky as the capital appreciation component of total return.

Disadvantages of the dividend yield approach include:

- The focus on dividend yield is incomplete because it ignores capital appreciation.
- The dividend displacement of earnings concept argues that dividends paid now displace future earnings, which implies a trade-off between current and future cash flows.

Total return on an investment has two components: dividend yield and capital appreciation. *Dividend yield* (D/P) is the ratio of trailing or leading dividend divided by current market price per share:

$$\text{trailing D/P} = \frac{4 \times \text{most recent quarterly dividend}}{\text{market price per share}}$$

$$\text{leading D/P} = \frac{\text{forecasted dividends over next four quarters}}{\text{market price per share}}$$

The supposed lower risk of dividends relative to capital appreciation assumes that the market is biased in its risk assessment of the components of return.

EXAMPLE: Calculating dividend yield

OnePrice, Inc., just paid a dividend of $0.50 per share. The consensus forecasted dividends for OnePrice, Inc., over the next four quarters are $0.50, $0.55, $0.60, and $0.65. The current market price is $47.50. Calculate the leading and trailing dividend yield.

Answer:

$$\text{trailing D/P} = \frac{4 \times \$0.50}{\$47.50} = 0.042 = 4.2\%$$

$$\text{leading D/P} = \frac{\$0.50 + \$0.55 + \$0.60 + \$0.65}{\$47.50} = \frac{\$2.30}{\$47.50} = 0.048 = 4.8\%$$

LOS 22.e: Calculate and interpret underlying earnings, explain methods of normalizing earnings per share (EPS), and calculate normalized EPS.

Underlying Earnings

Calculating the P/E ratio is easy, and estimating the market price is usually straightforward. However, estimating the appropriate earnings measure is crucial to successfully using the P/E ratio in market-based valuation. The key focus of an analyst is estimating **underlying earnings** (a.k.a. persistent, continuing, or core earnings), which are earnings that exclude nonrecurring components, such as gains and losses from asset sales, asset write-downs, provisions for future losses, and changes in accounting estimates.

For comparative purposes, analysts generally use diluted EPS, so that the effect of any dilutive securities is taken into account.

PROFESSOR'S NOTE

There is an important link here to financial statement analysis. The basic inputs to most valuation models (like earnings) are found in the financial statements. However, management has significant discretion in determining reported earnings by classifying specific items as nonrecurring. The analyst's job is to identify the recurring components of earnings that reflect the firm's true earning power.

EXAMPLE: Calculating underlying earnings

Using the data in the following figure, calculate the trailing P/E for Magnolia Enterprises as of September 2022 using underlying earnings.

Data for Magnolia Enterprises [amounts in Canadian dollars (C$)]

			Nonrecurring Items	
Quarter Ending	Stock Price (C$)	Reported Diluted EPS (C$)	Gain on Asset Sales (C$)	Extraordinary Expense (C$)
December 2021	38.50	1.45		
March 2022	46.25	1.30	0.30	
June 2022	48.50	1.40		0.55
September 2022	44.85	1.35		

Answer:

12-month EPS = 1.45 + 1.30 + 1.40 + 1.35 = C$5.50

underlying earnings = 5.50 – 0.30 + 0.55 = C$5.75

$$\text{trailing P/E} = \frac{\text{C\$44.85}}{\text{C\$5.75}} = 7.80 \text{ times}$$

Earnings contain a transitory portion that is due to cyclicality. While viewed as currently transitory, business cycles are expected to repeat over the long term. The countercyclical tendency to have high P/Es due to lower EPS at the bottom of the cycle and low P/Es due to high EPS at the top of the cycle is known as the *Molodovsky effect*.

Normalized Earnings

Analysts adjust P/Es for cyclicality by estimating **normalized (or normal) earnings per share**, which is an estimate of EPS in the middle of the business cycle. The following two methods are used to normalize earnings:

1. Under **the method of historical average EPS**, the normalized EPS is estimated as the average EPS over some recent period, usually the most recent business cycle.
2. Under **the method of average return on equity**, normalized EPS is estimated as the average return on equity (ROE) multiplied by the current book value per share (BVPS). Once again, average ROE is often measured over the most recent business cycle. The reliance on BVPS reflects the effect of firm size changes more accurately than does the method of historical average EPS.

The method of historical average EPS ignores size effects, so the method of average ROE is preferred.

EXAMPLE: Calculating normalized earnings

Using the data in the following figure, calculate normalized earnings using the method of historical average EPS and the method of average return on equity for Magnolia Enterprises.

Data for Magnolia Enterprises [amounts in Canadian dollars (C$)]

Year	2020	2021	2022	2023
EPS	C$4.20	C$3.75	C$4.75	C$4.30
BVPS	C$26.02	C$27.78	C$29.25	C$32.29
ROE	14.0%	12.0%	16.0%	14.0%

Answer:

$$\text{normalized earnings (average EPS approach)} = \frac{4.20 + 3.75 + 4.75 + 4.30}{4} = \text{C\$4.25}$$

$$\text{average ROE} = \frac{0.14 + 0.12 + 0.16 + 0.14}{4} = 0.14 = 14.00\%$$

$$\begin{aligned}\text{normalized earnings (average ROE approach)} &= \text{average ROE} \times \text{BVPS}_{2023} \\ &= 0.14 \times \text{C\$32.29} \\ &= \text{C\$4.52}\end{aligned}$$

Normalized earnings are C$4.25 based on the method of historical average EPS and C$4.52 based on the method of average return on equity.

LOS 22.f: Explain and justify the use of earnings yield (E/P).

Negative earnings render P/E ratios meaningless. In such cases, it is common to use normalized EPS and/or restate the ratio as the **earnings yield (E/P)** because price is never negative. A high E/P suggests a *cheap* security, and a low E/P suggests an *expensive* security, so securities can be ranked from cheap to expensive based on E/P ratios.

LOS 22.g: Describe fundamental factors that influence alternative price multiples and dividend yield.

LOS 22.i: Calculate and interpret the justified price-to-earnings ratio (P/E), price-to-book ratio (P/B), and price-to-sales ratio (P/S) for a stock, based on forecasted fundamentals.

PROFESSOR'S NOTE

We organized the material related to these two LOS by ratio. We start with the formula for the justified price multiple. If you know the formula, you know the fundamental factors. Notice that the LOS asks us to "describe" all of the justified price multiples plus the dividend yield, but only to "calculate" three: P/E, P/B, and P/S.

Justified P/E Multiple

As we said earlier, the justified P/E price multiple is a P/E ratio with the "P" in the numerator equal to the fundamental value derived from a valuation model. The best way to analyze the fundamental factors that affect the P/E ratio is to use the single-stage Gordon growth model:

$$V_0 = \frac{D_0 \times (1+g)}{(r-g)} = \frac{D_1}{(r-g)}$$

where:
V_0 = fundamental value
D_0 = dividend just paid
D_1 = dividends expected to be received at end of Year 1
r = required return on equity
g = dividend growth rate

If we express D_0 as the product of current earnings per share (E_0) and the payout ratio (D_0 / E_0) and express the retention rate as b, the previous formula becomes trailing P/E:

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{D_0 \times (1+g)/E_0}{r-g} = \frac{(1-b) \times (1+g)}{r-g}$$

Recognizing that $E_1 = E_0 (1 + g)$ and $D_1 = D_0 (1 + g)$, the leading P/E is calculated as:

$$\frac{D_0}{P_0} = \frac{r-g}{1+g}$$

PROFESSOR'S NOTE

Remember that if earnings are expected to grow, E_1 will be greater than E_0, and the justified leading P/E (P_0/E_1) will be smaller than the justified trailing P/E (P_0 /E_0) because you're dividing by a larger number when you are calculating leading P/E. In fact, trailing P/E will be larger than leading P/E by a factor of (1 + g): justified trailing P/E = justified leading P/E × (1 + g).

By examining the formulas for justified (leading and trailing) P/E, we can conclude that the fundamental factors that affect P/E are expected growth rate and required return (which is related to risk). The justified P/E ratio is:

- Positively related to the growth rate of expected cash flows, whether defined as dividends or free cash flows, all else equal.

- Inversely related to the stock's required rate of return, all else equal.
- While not directly apparent, P/E ratio is positively related to inflation pass-through rate. If two similar companies operate in the same inflationary environment, the firm with the higher **inflation pass-through rate** (i.e., ability to pass some portion of higher costs on to customers) should have the higher P/E ratio.

EXAMPLE: Calculating justified P/E ratio for Comtronics again

Shares of Comtronics are selling for $30. The mean analyst earnings per share forecast for next year is $4, and the long-run growth rate is 5%. Comtronics has a dividend payout ratio of 60% and a required return of 14%. Calculate the justified leading P/E ratio.

Answer:

$$\text{justified leading P/E} = \frac{1-b}{r-g} = \frac{0.60}{0.14-0.05} = 6.67 \text{ times}$$

This is the same answer we got when we calculated Comtronics' P/E the "long way" in the example at the beginning of this topic review.

EXAMPLE: Calculating justified P/E ratio

A stock has a payout ratio of 40%. The shareholders require a return of 11% on their investment, and the expected growth rate in dividends is 5%. Calculate the trailing and leading P/E multiple based on these forecasted fundamentals.

Answer:

$$\text{justified trailing P/E} = \frac{(1-b)\times(1+g)}{r-g} = \frac{0.40 \times 1.05}{0.11-0.05} = 7.00$$

$$\text{justified leading P/E} = \frac{1-b}{r-g} = \frac{0.40}{0.11-0.05} = 6.67$$

or

$$\text{justified trailing P/E} = 6.67 \times (1.05) = 7.00$$

Justified P/B Multiple

Using the sustainable growth relation of g = ROE × b and observing that $E_1 = B_0 \times ROE$, we can also derive the justified P/B from the Gordon growth model as:

$$\text{justified P/B ratio} = \frac{ROE-g}{r-g}$$

where:
ROE = return on equity
r = required return on equity
g = expected growth rate in dividends and earnings

We can draw two useful conclusions from this formula concerning the fundamentals that influence the P/B ratio:

- P/B increases as ROE increases, all else equal.
- The larger the spread between ROE and *r*, all else equal, the higher the P/B ratio. This makes sense if you remember that ROE is the return on the firm's investment projects and *r* is the required return. The larger the spread, all else equal, the more

value the firm is creating through its investment activities and the higher its market value as represented by V_0.

We can then use fundamental forecasts of ROE, r, and g to find a value for this ratio.

EXAMPLE: Calculating justified P/B ratio

A firm's ROE is 14%, its required rate of return is 8%, and its expected growth rate is 4%. Calculate the firm's justified P/B based on these fundamentals.

Answer:

$$\text{justified P/B ratio} = \frac{\text{ROE} - g}{r - g} = \frac{0.14 - 0.04}{0.08 - 0.04} = 2.5$$

Justified P/S Multiple

Since net profit margin (PM_0) is equal to E_0/S_0, we can also restate the Gordon growth model as:

$$\text{justified } \frac{P_0}{S_0} = \frac{(E_0/S_0) \times (1 - b) \times (1 + g)}{r - g}$$

Net profit margin (E_0/S_0) thus influences P/S directly as well as indirectly through its effect on the sustainable growth rate, g:

$$g = \text{retention ratio} \times \text{net profit margin} \times \left(\frac{\text{sales}}{\text{assets}}\right) \times \left(\frac{\text{assets}}{\text{shareholders' equity}}\right)$$

This means that the P/S ratio will increase, all else equal, if:

- Profit margin increases.
- Earnings growth rate increases.

We can also do a little algebra and solve for P/S as a function of trailing P/E, which might be an easier formula to remember:

$$\text{justified } \frac{P_0}{S_0} = (E_0/S_0) \times \left[\frac{(1 - b) \times (1 + g)}{r - g}\right]$$

$$= \text{net profit margin} \times \text{justified trailing P/E}$$

EXAMPLE: Calculating justified P/S ratio

A stock has a dividend payout ratio of 40%, a return on equity (ROE) of 8.3%, an EPS of $4.25, sales per share of $218.75, and an expected growth rate in dividends and earnings of 5%. Shareholders require a return of 10% on their investment. Calculate the justified P/S multiple based on these fundamentals.

Answer:

The ratio E_0/S_0 is the profit margin. In this example, the profit margin is ($4.25 / $218.75) = 0.0194. Therefore, we get:

$$\frac{P_0}{S_0} = \frac{0.0194 \times 0.4 \times 1.05}{0.10 - 0.05} = 0.163 \text{ times}$$

Justified P/CF Multiple

The *justified price to cash flow* based on fundamentals can be calculated by finding the value of the stock using a DCF model and dividing the result by the chosen measure of cash flow. For example, equity value using the single-stage FCFE model is:

$$V_0 = \frac{FCFE_0 \times (1+g)}{r-g}$$

P/CF will increase, all else equal, if:

- Required return decreases.
- Growth rate increases.

Justified EV/EBITDA Multiple

The justified EV/EBITDA based on fundamentals is simply the enterprise value based on a forecast of fundamentals divided by EBITDA forecast based on fundamentals. The ratio is:

- Positively related to the growth rate in FCFF and EBITDA.
- Negatively related to the firm's overall risk level and weighted average cost of capital (WACC).

Justified Dividend Yield

The dividend yield relative to fundamentals may be expressed in terms of the Gordon growth model as:

$$\frac{D_0}{P_0} = \frac{r-g}{1+g}$$

Dividend yield is:

- Positively related to the required rate of return.
- Negatively related to the forecasted growth rate in dividends. This implies that choosing high dividend yield stocks reflects a value rather than a growth investment strategy.

LOS 22.h: Calculate and interpret a predicted P/E, given a cross-sectional regression on fundamentals, and explain limitations to the cross-sectional regression methodology.

Cross-sectional regression refers to a regression in which the explained and explanatory variables are all based on the same point in time.

A **predicted P/E** can be estimated from linear regression of historical P/Es on its fundamental variables, including expected growth and risk. While such empirical analysis can provide an analyst with useful insight, there are three *main limitations*:

- The predictive power of the estimated P/E regression for a different time period and/or sample of stocks is uncertain.
- The relationships between P/E and the fundamental variables examined may change over time.

- Multicollinearity is often a problem in these time series regressions, which makes it difficult to interpret individual regression coefficients.

PROFESSOR'S NOTE
Remember from the Quantitative Methods topic area that multicollinearity refers to the condition in which a high correlation exists between or among two or more of the independent variables in a multiple regression.

EXAMPLE: Calculating predicted P/E

An analyst is valuing a public utility with a dividend payout ratio of 0.50, a beta of 0.95, and an expected earnings growth rate of 0.06. A regression on other public utilities produces the following regression equation:

$$\text{predicted P/E} = 6.75 + (4.00 \times \text{dividend payout}) + (12.35 \times \text{growth}) - (0.5 \times \text{beta})$$

The firm's P/E ratio is 12.0. Calculate the predicted P/E on the basis of the values of the explanatory variables for the company, and determine whether the stock is over- or underpriced.

Answer:

$$\text{predicted P/E} = 6.75 + (4.00 \times 0.50) + (12.35 \times 0.06) - (0.5 \times 0.95) = 9.02$$

Actual P/E is greater than predicted P/E, so the firm is overpriced.

PROFESSOR'S NOTE
This is an example of predicting the value of a dependent variable from an estimated regression equation as we did in the Quantitative Methods topic area. A P/E prediction model like this could form the basis for a quant question on the exam.

Warm-Up: Benchmarks

PROFESSOR'S NOTE
The phrase "benchmark value of a multiple" is another name for the justified price multiple using the method of comparables. We use the term "benchmark" in the discussion that follows to be consistent with the wording of the LOS.

The method of comparables approach to valuation compares a stock's price multiple to a benchmark of the multiple using the following steps:

Step 1: Select and calculate the multiple that will be used.

Step 2: Select the benchmark and calculate the mean or median of its multiple over the group of comparable stocks.

Step 3: Compare the stock's multiple to the benchmark.

Step 4: Examine whether any observed difference between the multiples of the stock and the benchmark are explained by the underlying determinants of the multiple, and make appropriate valuation adjustments.

Frequently encountered P/E benchmarks include:

- P/E of another company's stock in a similar industry with similar operating characteristics.
- Average or median P/E of peer group within the company's industry.
- Average or median P/E for the industry.
- P/E of an equity index.
- Average historical P/E for the stock.

LOS 22.l: Evaluate whether a stock is overvalued, fairly valued, or undervalued based on comparisons of multiples.

LOS 22.m: Evaluate a stock by the method of comparables and explain the importance of fundamentals in using the method of comparables.

The basic idea of the method of comparables is to compare a stock's price multiple to that of a benchmark portfolio. *Firms with multiples below the benchmark are undervalued, and firms with multiples above the benchmark are overvalued.* However, the fundamentals of the stock should be similar to the fundamentals of the benchmark before we can make direct comparisons and draw any conclusions about whether the stock is overvalued or undervalued. In other words, we have to ensure that we're comparing apples to apples. That's why the fundamental variables (i.e., the fundamentals) that affect each multiple are important in applying the method of comparables.

Let's use the P/E ratio as an example. Remember that justified P/E is positively related to growth rates and negatively related to required rate of return and risk. Suppose we determine that the P/E of our stock is less than the benchmark. There are (at least) three possible explanations for this:

- The stock is undervalued.
- The stock is properly valued, but the stock has a lower expected growth rate than the benchmark, which leads to a lower P/E.
- The stock is properly valued, but it has a higher required rate of return (higher risk) than the benchmark, which leads to a lower P/E.

In order to conclude that the stock is truly undervalued, we have to make sure that the stock is comparable to the benchmark; it should have similar expected growth and similar risk.

EXAMPLE: Evaluating P/E ratios with the method of comparables

An analyst has gathered P/E information on two stocks, Allbright Interiors and Basic Designs.

Market Data on Allbright Interiors and Basic Designs

	Trailing P/E	Leading P/E	5-Year Growth Rate	Beta
Allbright	10.0	8.7	11.0%	1.3
Basic Designs	14.0	12.7	9.0%	1.4
Peer median	13.3	12.1	11.0%	1.3

Evaluate the value and P/E of each stock based on the method of comparables.

Answer:

Allbright has a lower P/E than the peer median, despite the fact that it has a comparable growth rate and beta. This indicates Allbright is undervalued. Basic Designs, on the other hand, has a higher P/E, despite lower expected growth and a higher beta, which suggests it's overvalued relative to the benchmark.

The same steps used in valuing stocks with P/Es apply when using P/Bs. The *major difference* between the approaches is that book value forecasts are not widely disseminated like they are for EPS. Thus, most analysts use *trailing book values* in calculating P/Bs. Relative P/B valuation must consider differences in ROE, risk, and expected growth in making comparisons among stocks.

P/S valuation using the method of comparables follows the same steps as for P/E and P/B. However, P/S ratios are usually calculated based on *trailing sales*. Analysts need to control for profit margin, expected growth, risk, and the quality of accounting data in making comparisons.

EXAMPLE: Evaluating P/B and P/S ratios with the method of comparables

Crisco Systems belongs to the Networking Products industry group, and Soothsayer belongs to the Enterprise Software/Services industry group. Recall that the P/B ratios for Crisco and Soothsayer were 4.45 and 10.04, respectively, and the P/S ratios were 6.60 and 6.71. Determine whether the two stocks are overvalued or undervalued compared to their peer group means and medians.

Basic Data From the Computer Industry

Peer Group	Mean P/B	Median P/B	Mean P/S (sales in millions of $)	Median P/S (sales in millions of $)
Networking Products	2.065	1.170	3.733	0.900
Enterprise Software/ Services	7.866	2.770	3.341	1.920

Answer:

The P/B ratio for Crisco Systems exceeds the mean P/B ratio for the peer group (2.065) as well as the median P/B ratio (1.170) for the peer group; therefore, by this measure the stock would appear to be overvalued. The P/S ratio also exceeds both the mean P/S (3.733) and the median P/S (0.900) for the peer group, which also indicates that the stock is overvalued.

The P/B ratio for Soothsayer exceeds the peer group mean P/B (7.866) as well as the peer group median P/B (2.770) and suggests that the stock is overvalued. Similarly, the P/S ratio for Soothsayer exceeds the peer group mean P/S (3.341) as well as the peer group median P/S (1.920) and indicates that Soothsayer stock is overvalued as well.

Note the significant disparity between the mean and median values for each peer group. This is a clear indication of the presence of outliers in the data.

In line with other valuations by comparables discussed earlier (P/E, P/B, and P/S), a lower EV/EBITDA relative to peer firms indicates relative undervaluation, everything else being equal, and a higher ratio indicates overvaluation.

The process for dividend yield is similar to that for other multiples. An analyst compares the target company's dividend yield with that of peers to assess whether it is attractively priced. This assumes that the peers have been identified on the basis of comparable risk. Particular emphasis should be placed on determining whether any difference in dividend yield is due to expected growth differences. High dividend yield relative to the benchmark indicates undervaluation, all else equal.

PROFESSOR'S NOTE

If we are backtesting an investment strategy that uses screening to select stocks based on price multiples or other data, we should be careful to avoid look-ahead bias. Look-ahead bias happens when we make use of information that was not contemporaneously available at the historical time the stocks would have been selected.

The Fed and Yardeni Models

The **Fed model** considers the overall market to be overvalued (undervalued) when the earnings yield (i.e., the E/P ratio) on the S&P 500 Index is lower (higher) than the yield on 10-year U.S. Treasury bonds.

The **Yardeni model** includes expected earnings growth rate in the analysis:

$$\text{CEY} = \text{CBY} - k \times \text{LTEG} + \varepsilon_t$$

where:

CEY = current earnings yield of the market
CBY = current Moody's A-rated corporate bond yield
LTEG = five-year consensus earnings growth rate
k = constant assigned by the market to earnings growth (about 0.20 in recent years)

Taking reciprocals of the Yardeni model (and ignoring the error term), we get:

$$\frac{\text{P}}{\text{E}} = \frac{1}{\text{CBY} - k \times \text{LTEG}}$$

This shows that the P/E ratio is negatively related to interest rates and positively related to growth.

LOS 22.j: Calculate and interpret the P/E-to-growth (PEG) ratio and explain its use in relative valuation.

The relationship between earnings growth and P/E is captured by the **P/E-to-growth (PEG) ratio**:

$$\text{PEG ratio} = \frac{\text{P/E ratio}}{\text{g}}$$

The PEG is interpreted as P/E per unit of expected growth. Remember that the growth rate is one of the fundamental factors that affect P/E (P/E is directly related to the growth rate). The PEG ratio, in effect, "standardizes" the P/E ratio for stocks with

different expected growth rates. The implied valuation rule is that stocks with lower PEGs are more attractive than stocks with higher PEGs, assuming that risk is similar.

> **EXAMPLE: Calculating and using the PEG ratio**
>
> Med-Ready, Inc., has a leading P/E of 28.75 and a 5-year consensus growth rate forecast of 14.5%. The median PEG for a group of companies comparable in risk to Med-Ready is 2.34. Calculate the firm's PEG and explain whether the stock appears to be correctly valued, overvalued, or undervalued.
>
> **Answer:**
>
> The firm's PEG is 28.75 / 14.5 = 1.98. Given the comparable group median PEG of 2.34, it appears that Med-Ready may be undervalued. However, it is important for the analyst to determine whether the peer group PEG is also based on leading P/Es and whether the comparable firms are similar in risk.

There are a number of drawbacks to using the PEG ratio:

- The relationship between P/E and g is not linear, which makes comparisons difficult.
- The PEG ratio still doesn't account for risk.
- The PEG ratio doesn't reflect the duration of the high-growth period for a multistage valuation model, especially if the analyst uses a short-term high-growth forecast.

LOS 22.k: Calculate and explain the use of price multiples in determining terminal value in a multistage discounted cash flow (DCF) model.

A terminal value that is projected as of the end of the investment horizon should reflect the earnings growth that a firm can sustain over the long run, beyond that point in time. Analysts often use terminal price multiples like P/E, P/B, P/S, and P/CF to estimate terminal value. No matter which ratio is used, terminal value is calculated as the product of the price multiple (e.g., P/E ratio) and the fundamental variable (e.g., EPS).

There are two methods of estimating the price multiple: based on fundamentals and based on comparables. The terminal price multiple based on fundamentals is the product of the justified price multiple and an estimate of the fundamental value. For example, the terminal value based on a justified P/E ratio is:

$$\text{terminal value in year n} = (\text{justified leading P/E ratio}) \times (\text{forecasted earnings in year n} + 1)$$

$$\text{terminal value in year n} = (\text{justified trailing P/E ratio}) \times (\text{forecasted earnings in year n})$$

The terminal price multiple based on comparables is calculated as the benchmark price multiple and an estimate of the fundamental value. For example, the terminal value based on a benchmark P/E is:

$$\text{terminal value in year n} = (\text{benchmark leading P/E ratio}) \times (\text{forecasted earnings in year n} + 1)$$

$$\text{terminal value in year n} = (\text{benchmark trailing P/E ratio}) \times (\text{forecasted earnings in year n})$$

The strength of the comparables approach is that it uses market data exclusively. In contrast, the fundamentals approach requires estimates of the growth rate, required rate of return, and payout ratio. One weakness of the comparables approach is that a benchmark marred by mispricing will transfer that error to the estimated terminal value.

EXAMPLE: Calculating terminal value with price multiples

An analyst estimates the EPS of Polar Technology in five years to be C$2.10, the EPS in six years to be C$2.32, and the median trailing industry P/E to be 35. Calculate the terminal value in Year 5.

Answer:

terminal value in Year 5

= (benchmark trailing P/E ratio) × (forecasted earnings in Year 5)

= 35 × C$2.10 = C$73.50

LOS 22.n: Explain alternative definitions of cash flow used in price and enterprise value (EV) multiples and describe limitations of each definition.

There are at least four definitions of cash flow available for use in calculating the P/CF ratio: (1) earnings-plus-noncash-charges (CF); (2) adjusted cash flow (adjusted CFO); (3) free cash flow to equity (FCFE); and (4) earnings before interest, taxes, depreciation, and amortization (EBITDA). Expect to see any one of them on the exam.

One commonly used proxy for cash flow is **earnings-plus-noncash-charges (CF)**:

CF = net income + depreciation + amortization

The limitation of this definition, as we mentioned previously, is that it ignores some items that affect cash flow, such as noncash revenue and changes in net working capital.

Another proxy for cash flow is cash flow from operations (CFO) from the cash flow statement. CFO is often adjusted for nonrecurring cash flows. US GAAP requires interest paid, interest received, and dividends received to be classified as operating cash flows. IFRS, however, is more flexible: interest paid may be classified as either an operating or financing cash flow, while interest and dividends received can be classified as either operating or investing cash flows. Thus, care should be taken when comparing firms reporting under different standards.

Analysts also often use **free cash flow to equity (FCFE)** and **earnings before interest, taxes, depreciation, and amortization (EBITDA)** as proxies for cash flow. As we mentioned previously, theory suggests that FCFE is the preferred way to define cash flow, but it is more volatile than straight cash flow.

FCFE = CFO − FCInv + net borrowing

where:

FCInv = fixed capital investment

net borrowing = (long- and short-term debt issues) − (long- and short-term debt repayments)

EBITDA is a pretax, pre-interest measure that represents a flow to both equity and debt. Thus, it is better suited as an indicator of total company value than just equity value. More on this point is provided in our discussion of the enterprise value-to-EBITDA ratio.

Analysts typically use *trailing* price to cash flow ratio, which relies on the most recent four quarters of cash flow per share. Given one of the four definitions of cash flow, the P/CF ratio is calculated as:

$$\text{P/CF ratio} = \frac{\text{market value of equity}}{\text{cash flow}} = \frac{\text{market price per share}}{\text{cash flow per share}}$$

where:
cash flow = CF, adjusted CFO, FCFE, or EBITDA

EXAMPLE: Calculating P/CF

Data Management Systems, Inc., (DMS) reported net income of $32 million, depreciation and amortization of $41 million, net interest expense of $12 million, and cash flow from operations of $44 million. The tax rate is 30%. Calculate the P/CF ratio using earnings-plus-non-cash-charges (CF) as a proxy for cash flow. DMS has 25 million shares of common stock outstanding, trading at $47 per share.

Answer:

$$\text{CF} = \$32 \text{ million} + \$41 \text{ million} = \$73 \text{ million}$$

$$\text{market value of equity} = 25 \text{ million shares} \times \$47 \text{ per share} = \$1{,}175 \text{ million}$$

$$\text{P/CF} = \frac{\$1{,}175 \text{ million}}{\$73 \text{ million}} = 16.1 \text{ times}$$

LOS 22.o: Calculate and interpret EV multiples and evaluate the use of EV/EBITDA.

Because EBITDA is a flow to both equity and debt, it should be related to a numerator that measures total company value. **Enterprise value (EV)** is total company value:

EV = market value of common stock + market value of preferred equity + market value of debt + minority interest − cash and investments

The rationale for subtracting cash and investments is that an acquirer's net price paid for an acquisition target would be lowered by the amount of the target's liquid assets. Thus, enterprise value indicates the value of the overall company, not equity.

PROFESSOR'S NOTE
For our discussion going forward, we will assume minority interest and preferred equity is zero (which is typical). If, on the exam, you are given values for preferred stock and/or minority interest, do include them.

EV/EBITDA is the ratio of enterprise value to EBITDA:

$$\text{EV/EBITDA ratio} = \frac{\text{enterprise value}}{\text{EBITDA}}$$

where:

enterprise value = market value of common stock + marked value of debt – cash and investments

EBITDA = recurring earnings from continuing operations + interest + taxes + depreciation + amortization

or for forecasting

= EBIT + depreciation + amortization

EV/EBITDA is useful in a number of situations:

- The ratio may be more useful than P/E when comparing firms with different degrees of financial leverage.
- EBITDA is useful for valuing capital-intensive businesses with high levels of depreciation and amortization.
- EBITDA is usually positive even when EPS is not.

EV/EBITDA has a number of drawbacks, however:

- If working capital is growing, EBITDA will overstate CFO. Further, the measure ignores how different revenue recognition policies affect CFO.
- Because FCFF captures the amount of capital expenditures, it is more strongly linked with valuation theory than EBITDA. EBITDA will be an adequate measure if capital expenses equal depreciation expenses.

EXAMPLE: Calculating EV/EBITDA

An analyst gathered the following data for Boulevard Industries [all amounts in Swiss francs (Sf)]:

Recent share price	Sf 22.50
Shares outstanding	40 million
Market value of debt	Sf 137 million
Cash and marketable securities	Sf 62.3 million
Investments	Sf 327 million
Net income	Sf 137.5 million
Interest expense	Sf 6.9 million
Depreciation and amortization	Sf 10.4 million
Taxes	Sf 95.9 million

Based on this information, calculate the EV/EBITDA ratio for Boulevard Industries.

Answer:

EBITDA = 137.5 + 6.9 + 95.9 + 10.4 = Sf 250.7 million

EV = (22.50 × 40) + 137 – 62.3 – 327 = Sf 647.7 million

$$\text{EV/EBITDA} = \frac{\text{Sf 647.7 million}}{\text{Sf 250.7 million}} = 2.6 \text{ times}$$

An alternative measure of a company's overall value is **total invested capital (TIC)**, sometimes referred to as **market value of invested capital**. Total invested capital is the

market value of the company's equity and debt. Unlike enterprise value, TIC includes cash and short-term investments.

In addition to EV/EBITDA and TIC/EBITDA, analysts employ enterprise value ratios with EBIT, FCFF, or other items in the denominator. For example, the *enterprise value to sales* (EV/S) ratio can be used as an alternative to the P/S ratio. The EV/S ratio is appropriate for comparing companies with significantly different capital structures.

LOS 22.p: Explain sources of differences in cross-border valuation comparisons.

Using relative valuation methods that require the use of comparable firms is challenging in an international context due to **differences in accounting methods, cultures, risk, and growth opportunities**. Further, benchmarking is difficult because P/Es for individual firms in the same industry vary widely internationally and country market P/Es can vary significantly. Common differences in international accounting treatment fall into several categories: goodwill, deferred income taxes, foreign exchange adjustments, R&D, pension expense, and tangible asset revaluations.

The usefulness of all price multiples is affected to some degree by differences in international accounting standards. The least affected is P/FCFE, while P/B, P/E, P/EBITDA, and EV/EBITDA will be more seriously affected because they are more influenced by management's choice of accounting methods and estimates.

LOS 22.q: Describe momentum indicators and their use in valuation.

Momentum indicators relate either the market price or a fundamental variable (such as EPS) to the time series of historical or expected value. Common momentum indicators include earnings surprise, standardized unexpected earnings, and relative strength.

Unexpected earnings or **earnings surprise** is the difference between reported earnings and expected earnings:

$$\text{earnings surprise} = \text{reported EPS} - \text{expected EPS}$$

This is usually scaled by a measure that expresses the variability of analysts' EPS forecasts. The economic rationale for examining earnings surprises is that positive surprises may lead to persistent positive abnormal returns.

Similarly, the **standardized unexpected earnings (SUE)** measure is defined as:

$$\text{standardized unexpected earnings (SUE)} = \frac{\text{earnings surprise}}{\text{standard deviation of earnings surprise}}$$

A given size forecast error is more meaningful the smaller the size of the historical forecast errors.

Relative strength indicators compare a stock's price or return performance during a given time period with its own historical performance or with some group of peer stocks. The economic rationale is that patterns of persistence or reversal may exist in stock returns. These are thought to possibly depend on the length of an investor's time horizon.

LOS 22.r: Explain the use of the arithmetic mean, the harmonic mean, the weighted harmonic mean, and the median to describe the central tendency of a group of multiples.

The price-to-earnings multiple for a stock index is not equal to the mean or weighted mean of the P/Es of the portfolio stocks. Consider two stocks: one priced at $10 with earnings of $1 per share (P/E = 10) and one priced at $16 with earnings of $2 (P/E = 8). For a portfolio with one share of each stock, earnings per share are 1 + 2 = 3 and the "price" of a portfolio share is 10 + 16 = 26. The portfolio price-to-earnings is 26 / 3 = 8.67.

We will demonstrate that the portfolio or index P/E (as well as other relative value ratios based on price) is best calculated as the **weighted harmonic mean** P/E. With the P/Es denoted by *X* and the weights as *w*, we have:

$$\text{weighted harmonic mean} = \frac{1}{\sum_{i=1}^{n} \frac{w_i}{X_i}}$$

Consider the following alternative measures of the mean P/E for the portfolio:

$$\text{arithmetic mean} = (8 + 10) / 2 = 9$$

$$\text{weighted mean} = (10 / 26) \times 10 + (16 / 26) \times 8 = 8.76$$

$$\text{harmonic mean} = \frac{2}{\left(\frac{1}{10}\right) + \left(\frac{1}{8}\right)} = 8.88$$

$$\text{weighted harmonic mean} = \frac{1}{\left(\frac{10}{26}\right)\left(\frac{1}{10}\right) + \left(\frac{16}{26}\right)\left(\frac{1}{8}\right)} = 8.67$$

An analyst must be aware of how portfolio P/Es are calculated to understand them. Note that when there are extreme (high or low) outliers, the arithmetic mean will be the most affected. Analysts should be aware that the harmonic mean puts more weight on smaller values. In this case, the median or weighted harmonic mean with the outliers excluded may be the most appropriate measures of the P/E for a portfolio or index. For an equal weighted portfolio or index, the harmonic mean and weighted harmonic mean will be equal.

MODULE QUIZ 22.2, 22.3, 22.4

1. An analyst researching Blue Ridge Camping has determined that the firm has:
   - A payout ratio of 75%.
   - A return on equity (ROE) of 18%.
   - An earnings per share (EPS) of $5.35.
   - Sales per share of $342.
   - Expected earnings/dividends/sales growth of 4.5%.
   - Shareholders required return of 15%.

   The firm's justified price to sales ratio (P/S) multiple based on the above fundamentals is *closest* to:

   A. 0.0780.
   B. 0.1114.
   C. 0.1164.

Use the following information to answer Questions 2 through 4.

Company	Book Value of Equity 2023 (millions of $)	Sales 2023 (millions of $)	Shares Outstanding 2023 (millions)	Price ($)
Pfeiffer, Inc.	19,950	32,373	6,162	31.37
Mapps, Inc.	61,020	32,187	10,771	25.63

Peer Group	Mean P/B	Median P/B	Mean P/S (sales in millions of $)	Median P/S (sales in millions of $)
Medical-Drugs	5.622	4.250	8.708	4.530
Applications Software	4.100	2.140	3.420	1.440

Pfeiffer belongs to the Medical-Drugs group and Mapps belongs to the Applications Software group.

2. The current price-to-book and price-to-sales ratios for Pfeiffer are *closest* to:

	P/B	P/S
A.	3.238	5.254
B.	3.238	5.971
C.	9.688	5.971

3. The current price-to-book and price-to-sales ratios for Mapps are *closest* to:

	P/B	P/S
A.	4.524	8.578
B.	5.665	2.988
C.	4.524	2.988

4. Which of the following statements is *most accurate*, given the financial data on Pfeiffer, Mapps, and the two industries?
   A. Both stocks are relatively overvalued.
   B. Both stocks are relatively undervalued.
   C. One stock is relatively overvalued and the other is relatively undervalued.

5. Jeremiah Claxton, CFA, is a junior portfolio manager for a large university endowment fund. Claxton's supervisor, Joanne LeMonte, has asked him to compare the valuation of Home Decor, Inc., and Lester's Companies, Inc., and make a recommendation for an addition to the fund's retail portfolio. LeMonte has specifically asked Claxton to consider the price-to-cash flow valuation metric when making his recommendation. Claxton has gathered the following information.

	Recent Price	Trailing CF per Share	P/CF	Trailing FCFE per Share	P/FCFE	Consensus 5-Year Growth Forecast	Beta
Lester's	$47.8	$2.00	23.90	$0.36	132.78	17.5%	1.22
Home	$28.4	$1.36	20.88	$0.99	28.69	22.2%	1.36

Claxton has also determined that the CAPM betas of the two firms are not significantly different at the 1% level. Based on the information in the table, which of the following statements is *most accurate*?
   A. Only one of the stocks is relatively overvalued.
   B. Both stocks are relatively undervalued.
   C. Both stocks are relatively overvalued.

Use the following information to answer Questions 6 through 9.

Lois Fischer, CFA, is a senior analyst with Merlin Equity Investors. Fischer believes that the retail industry will perform well over the next several quarters and is interested in

selecting a retail stock on the basis of its price-to-book multiple. Fischer's research has resulted in a list of five stocks from which she will make her final selection: Wally's, Home Decor, Redrug, Lester's, and Harmon's (all reporting under U.S. GAAP). The following table contains the information upon which Fischer will base her decision.

Price-to-Book Value							
	2020	2021	2022	3-Year Average	Current	2-Year ROE Forecast	Beta
Wally's*	9.85	8.01	6.93	8.26	6.53	20.00%	0.98
Harmon's*	6.35	4.60	4.16	5.04	3.29	19.95%	1.02
Redrug**	14.93	11.08	13.32	13.11	5.78	18.20%	0.58
Home Decor***	9.75	7.24	8.88	8.62	3.31	19.29%	1.36
Lester's***	7.65	6.25	6.66	6.85	4.32	18.90%	1.22
*Retail industry (department & discount)					5.75	19.98%	
**Retail industry (drugs)					4.69	15.27%	
***Retail industry (home improvement)					3.62	19.29%	

Annabelle Clementi, CFA, is Fischer's supervisor and has more than 15 years of experience analyzing firms in the retail industry. Clementi typically uses the P/B ratio when comparing retail stocks with the industry and among peers. However, Clementi has concluded that firms in the home improvement segment of the retail industry utilize their assets so efficiently that P/B valuation is not appropriate. Since these firms are typically characterized as having relatively strong cash flows, Clementi has decided to assess them using valuation measures that are based on cash flows and cash flow-related concepts. With this in mind, Clementi has obtained the following financial statements for Lester's, Inc., a major player in the home improvement segment of the retail industry. Other relevant information that will assist her with the valuation of Lester's includes the following:

- Lester's financial statements are prepared using U.S. GAAP.
- Actual interest paid for the year was $240 million. The reported cash flow from operating activities includes this effect, net of tax savings.
- The marginal tax rate is 37%.
- Lester's is currently trading at $42.10 per share.

Lester's, Inc., Income Statement

Period Ending December 31, 2022	
Total Revenue	22,111,108,000
Cost of Revenue	(15,743,267,000)
Gross Profit	$ 6,367,841,000
Operating Expenses	
Depreciation	534,102,000
Selling General and Administrative Expenses	3,379,253,000
Nonrecurring	139,870,000
Other Operating Expenses	516,828,000
Total Operating Expenses	$ 4,570,053,000
Operating Income	1,797,788,000
Total Other Income and Expenses, Net	58,431,000
Earnings Before Interest and Taxes	1,856,219,000
Interest Expense	(231,968,000)
Income Before Tax	$ 1,624,251,000
Income Tax Expense	600,989,000
Equity Earnings or Loss Unconsolidated Subsidiary	N/A
Minority Interest	N/A
Net Income From Continuing Operations	$ 1,023,262,000
Nonrecurring Events	
Discontinued Operations	N/A
Extraordinary Items	N/A
Effect of Accounting Changes	N/A
Other Items	N/A

Lester's, Inc., Statement of Cash Flows

Period Ending December 31, 2022

Net Income	$ 1,023,262,000
Cash Flow Operating Activities	
Depreciation	534,102,000
Changes in Operating Activities	
Changes in Accounts Receivables	(4,593,000)
Changes in Liabilities	306,869,000
Changes in Inventories	(325,406,000)
Changes in Other Operating Activities	(36,792,000)
Cash Flow From Operating Activities	$ 1,497,442,000
Cash Flow Investing Activities	
Capital Expenditures	(2,199,334,000)
Cash Flows From Investing Activities	$ (2,199,334,000)
Cash Flow Financing Activities	
Dividends Paid	(59,884,000)
Sale (Purchase) of Stock	115,870,000
Net Borrowings	873,480,000
Other Cash Flows From Financing Activities	N/A
Cash Flows From Financing Activities	$ 929,466,000
Effect of Exchange Rate	N/A
Change in Cash and Cash Equivalents	227,574,000
Cash and Cash Equivalents at Beginning of Period	455,658,000
Cash and Cash Equivalents at End of Period	$ 683,232,000

6. Based on the information in the first figure, which of the following statements *least likely* supports Fischer's recommendation of Home Decor over Lester's?
   A. Home Decor's P/B ratio relative to the industry.
   B. Home Decor's P/B ratio relative to Lester's P/B ratio.
   C. Home Decor's historical P/B ratios.

7. Which of the following statements is *least likely* a justification of Fischer's selection of Harmon's over Wally's on the basis of the information in the first figure?
   A. Harmon's level of systematic risk relative to Wally's.
   B. Harmon's P/B ratio relative to the industry.
   C. Wally's P/B ratio relative to the industry.

8. Clementi requests that Fischer calculate several ratios using the previous information. The P/CF for Lester's using earnings-plus-noncash-charges for cash flow is *closest* to:
   A. 15.89.
   B. 17.08.
   C. 25.99.

9. Clementi requests that Fischer calculate the P/CFO for Lester's, using adjusted cash flow from operations for cash flow for comparison with other companies. The adjusted P/CFO for Lester's is *closest* to:
   A. 15.
   B. 17.
   C. 19.

10. The 12-month trailing EPS for Sample Fabrication Company as of December 31, 2023, is $1.29. Sample stock trades at $42.50 per share as of 12/31/23. In the first quarter of 2023, Sample reported an extraordinary loss of $0.22 per share. In the third quarter, the company reported a loss from the write-down of inventory of $0.04 per share. In the fourth quarter, Sample reported a gain of $0.08 per share from a change in accounting estimate when it increased the estimate of useful life of certain manufacturing equipment. Sample's trailing P/E ratio based on underlying earnings is *closest* to:
    A. 24.6.
    B. 28.9.
    C. 32.9.

11. The average ROE for Lever, Inc., over the last business cycle was 32%. Lever's earnings per share for the coming year is expected to be $5. The dividend payout ratio is 30%, and the current book value per share is $14. Shares are trading in the market at $54. Lever's normalized earnings per share are *closest* to:
    A. $4.48.
    B. $5.00.
    C. $5.26.

12. Which of the following investment strategies is *most consistent* with choosing high dividend yield stocks?
    A. Growth.
    B. Momentum.
    C. Value.

13. An analyst is valuing an electric utility with a dividend payout ratio of 0.65, a beta of 0.56, and an expected earnings growth rate of 0.032. A regression on other electric utilities produces the following equation:

    $$\text{predicted P/E} = 8.57 + (5.38 \times \text{dividend payout}) + (15.53 \times \text{growth}) - (0.61 \times \text{beta})$$

    The predicted P/E on the basis of the values of the explanatory variables for the company is *closest* to:
    A. 12.2.
    B. 15.4.
    C. 20.8.

14. The stock of Western Graphics Co. paid a dividend of $0.40 per share *last* year on earnings of $1.00 per share. The firm's earnings and dividends are expected to grow at 5% per year forever. Shareholders require a return of 12% on their investment. The justified trailing and leading P/E multiples are *closest* to:

	Trailing P/E	Leading P/E
A.	6.0	5.7
B.	6.0	6.3
C.	5.7	6.3

15. Creative Toys recently paid a dividend of $1.35 a share. It has a payout ratio of 67%, a ROE of 23%, and an expected growth rate in earnings and dividends for the foreseeable future of 7.6%. Shareholders require a return of 14% on their investment. The justified price to book value multiple is *closest* to:
    A. 1.22.
    B. 1.19.
    C. 2.41.

16. Party Favors, Inc., has a leading P/E of 18.75 and a 5-year consensus growth rate forecast of 15.32%. The median PEG, based on leading P/E, for a group of companies comparable in risk to Party Favors, Inc., is 0.92. The stock appears to be:
    A. overvalued because its PEG ratio is 0.82.
    B. overvalued because its PEG ratio is 1.22.
    C. undervalued because its PEG ratio is 0.82.

17. Sabrina Valentine, CFA, has gathered the following data for Carolina Steel, Inc. (CSI):

Recent share price	$31.25
Shares outstanding	30 million
Market value of debt	$115 million
Cash and marketable securities	$47.6 million
Investments	$247 million
Net income	$119.4 million
Interest expense	$5.8 million
Depreciation	$6.9 million
Amortization	$2.3 million
Taxes	$85.9 million

The EV/EBITDA ratio for CSI is *closest* to:

A. 3.44.
B. 4.26.
C. 4.78.

KEY CONCEPTS

LOS 22.a

The method of comparables uses a price multiple for a similar firm or the average price multiple for a portfolio of stocks or an index as a benchmark value. The underlying economic argument for this method is that the value of a dollar of earnings or a dollar of book value, for example, should be the same across similar stocks or stocks in the same industry. Valuation based on the method of comparables is relative, based on the current market values of other stocks.

Rather than using current price multiples for other stocks, the method of forecasted fundamentals uses price multiples based on forecasted values for fundamental characteristics such as growth, dividend payout, or ROE. Under this method, we are assuming that a particular valuation model gives the stock's intrinsic value. As an example, consider the relation P/E = payout ratio / (required return − growth rate). This is the P/E for the stock if its price is equal to its value calculated using the constant growth model, an estimate of the absolute value of the stock.

LOS 22.b

A justified price multiple can be "justified" by either the method of comparables or by the method of forecasted fundamentals. As an example, consider the P/E justified by the constant growth (Gordon growth) model value. Stocks with P/Es less than their justified P/Es, based on forecasts of the fundamental variables involved, are judged to be undervalued. A similar argument can be made for stocks with P/Es less than that for a similar stock or benchmark P/E determined by the method of comparables.

LOS 22.c

Rationales for using price-to-earnings (P/E) ratio in valuation:

- Earnings power, as measured by earnings per share (EPS), is the primary determinant of investment value.
- The P/E ratio is popular in the investment community.
- Empirical research shows that P/E differences are significantly related to long-run average stock returns.

Disadvantages of using the price-to-earnings ratio include:

- Earnings can be negative.
- The volatile, transitory portion of earnings makes interpretation difficult.
- Management discretion distorts reported earnings.

Rationales for using price-to-book (P/B) ratio in valuation:

- Book value is a cumulative amount that is usually positive, even when the firm reports a loss and EPS is negative. Thus, a P/B can typically be used when P/E cannot.
- Book value is more stable than EPS, so it may be more useful than P/E when EPS is particularly high, low, or volatile.
- Book value is an appropriate measure of net asset value for firms that primarily hold liquid assets. Examples include finance, investment, insurance, and banking firms.
- P/B can be useful in valuing companies that are expected to go out of business.
- Empirical research shows that P/Bs help explain differences in long-run average stock returns.

Disadvantages of using the price-to-book ratio include:

- P/Bs do not recognize the value of nonphysical assets.
- P/Bs can mislead when there are significant size differences.
- Different accounting conventions can obscure the true investment in the firm made by shareholders.
- Inflation and technological change can cause the book and market value of assets to differ significantly.

Rationales for using price-to-sales (P/S) ratio in valuation:

- P/S is meaningful even for distressed firms.
- Sales revenue is not as easy to manipulate or distort as EPS and book value.
- P/S ratios are not as volatile as P/E multiples.
- P/S ratios are particularly appropriate for valuing stocks in mature or cyclical industries and start-up companies with no record of earnings.
- Empirical research finds that differences in P/S are significantly related to differences in long-run average stock returns.

Disadvantages of using the price-to-sales ratio include:

- Higher sales do not necessarily indicate higher operating profits.
- P/S ratios do not capture differences in cost structures across companies.
- While less subject to distortion than earnings, revenue recognition practices can distort sales forecasts.

Rationales for using price-to-cash flow (P/CF) ratio in valuation:

- Cash flow is harder for managers to manipulate than earnings.
- Price to cash flow is more stable than price to earnings.
- Reliance on cash flow rather than earnings handles the problem of differences in the quality of reported earnings, which is a problem for P/E.
- Empirical evidence indicates that differences in price to cash flow are significantly related to differences in long-run average stock returns.

Disadvantages of using the price to cash flow include:

- The EPS plus noncash charges estimate ignores items affecting actual cash flow from operations.
- FCFE is preferred but is more volatile than operating cash flow.

Rationales for using dividend yield in valuation:

- Dividend yield contributes to total investment return.
- Dividends are not as risky as the capital appreciation component of total return.

Disadvantages of using dividend yield include:

- Dividend yield is only one component of the return on a stock.
- All else equal, higher dividends will lead to slower growth, which drives the other component of returns, price appreciation.

LOS 22.d

- The trailing P/E ratio is market price per share divided by earnings per share over the last four reported quarters.
- The leading P/E ratio is market price per share divided by estimated earnings per share for the next four quarters.
- The price/sales ratio is the market price per share divided by sales per share.
- The price/book ratio is the market price per share divided by the book value (shareholders' equity) per share.
- The price/cash flow ratio is the market price per share divided by cash flow per share, which can be calculated in various ways.
- For all of these price ratios, a higher value indicates a greater relative stock value.
- The (expected) dividend yield is the expected dividend over the next four quarters divided by the current market price per share.

LOS 22.e

Underlying earnings are earnings that exclude nonrecurring components. Normalized earnings are earnings adjusted for the business cycle using either the method of historical EPS or the method of average ROE. The method of average ROE is preferred.

LOS 22.f

A high earnings yield (E/P) suggests a cheap security, and a low E/P suggests an expensive security, so securities can be ranked from cheap to expensive based on E/P ratios.

LOS 22.g

All else equal:

- The price-to-earnings ratio will be higher the greater the growth rate of earnings and the lower the required rate of return.
- The price-to-sales ratio will be higher the greater the net profit margin and the lower the required rate of return.
- The price-to-cash flow ratio will be higher the greater the growth rate of free cash flow to equity and the lower the required rate of return.
- The price-to-book ratio will be higher the greater the spread between ROE and the required rate of return.

- The dividend yield will be higher the greater the required rate of return and the lower the growth rate of earnings.

LOS 22.h

Predicted P/E can be estimated from linear regression of historical P/Es on its fundamental variables. In such a case, P/E is the dependent variable and company fundamentals (e.g., growth rate, beta, etc.) are independent variables.

LOS 22.i

Based on discounted cash flow valuation:

- The justified leading price-to-earnings ratio based on forecasted fundamentals can be calculated as:

$$P/E = \frac{P_0}{E_1} = \frac{\text{payout ratio}}{r - g}$$

- The justified price-to-book value ratio based on forecasted fundamentals can be calculated as:

$$\frac{P_0}{B_0} = \frac{ROE - g}{r - g}$$

- The justified price-to-sales ratio based on forecasted fundamentals can be calculated as:

$$\frac{P_0}{S_0} = \frac{(E_0/S_0) \times (1 - b) \times (1 + g)}{r - g}$$

LOS 22.j

The price earnings-to-growth (PEG) ratio is calculated as $\text{PEG ratio} = \frac{\text{P/E ratio}}{g}$.

Lower PEGs are more attractive than stocks with higher PEGs, all else equal.

LOS 22.k

Analysts often use price multiples such as P/E, P/B, P/S, and P/CF to estimate terminal value. No matter which ratio we use, terminal value is calculated as the product of the expected price multiple (e.g., P/E ratio) and the terminal value of the fundamental variable (e.g., EPS).

LOS 22.l

The basic idea of the method of comparables is to compare a stock's price multiple to the benchmark. Firms with multiples below the benchmark are undervalued, and firms with multiples above the benchmark are overvalued.

LOS 22.m

When using the method of comparables to identify attractively priced stocks, the analyst must account for differences in the stocks' fundamentals. A stock with a high P/E ratio may still be attractive because of its rapid growth, while a stock with a high dividend yield (low price-to-dividend) may be unattractive because earnings do not support the dividend and no growth is anticipated.

LOS 22.n

There are four measures of cash flow commonly used for cash flow multiples and enterprise value multiples:

1. Earnings plus noncash charges: EPS plus per-share depreciation, amortization, and depletion.
2. Cash flow from operations (CFO): Often adjusted by subtracting nonrecurring cash flows, and for different classifications of cash flows under differing accounting standards. This measure is more technically correct than earnings plus noncash charges.
3. Free cash flow to equity (FCFE): CFO minus capital expenditures, minus (plus) principal payments to (from) debtholders. Most closely linked to value theory but more volatile than other measures. Consider using average FCFE.
4. Earnings before interest, taxes, depreciation, and amortization (EBITDA): Depreciation and amortization are added to EBIT (for forecasting), or interest, taxes, depreciation, and amortization can be added to recurring earnings from continuing operations (for historical values). As a pre-interest earnings measure, EBITDA is a measure of cash flow to the firm, to both debt and equity holders.

LOS 22.o

Enterprise value (EV) is measured as the market value of debt, common equity, and any preferred equity, minus the value of cash and investments. EV/EBITDA is a commonly used measure of relative company value.

Advantages of EV/EBITDA:

- It is useful for comparing firms with different degrees of financial leverage.
- EBITDA is useful for valuing capital-intensive businesses with high depreciation.
- EBITDA is usually positive even when EPS is not.

Disadvantages of EV/EBITDA:

- If working capital is growing, EBITDA will overstate CFO.
- FCFF is more strongly linked with valuation theory than EBITDA.

LOS 22.p

Using relative valuation methods that require the use of comparable firms is challenging in an international context due to differences in accounting methods, cultures, risk, and growth opportunities.

LOS 22.q

Momentum indicators relate either the market price or a fundamental variable (such as EPS) to the time series of historical or expected value. Common momentum indicators include earnings surprise, standardized unexpected earnings, and relative strength.

LOS 22.r

When calculating the P/E or other price multiple for an index or portfolio, the arithmetic mean may be misleading. The most appropriate measure is the weighted harmonic mean of the individual asset P/Es using the portfolio or index weights.

$$\text{weighted harmonic mean} = \frac{1}{\sum_{i=1}^{n} \frac{w_i}{X_i}}$$

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 22.1

1. **C** Consumer Products appears to be undervalued with a trailing P/E of 27.52 compared with the benchmark of 33.25. (LOS 22.a)

2. **B**

$$\text{net profit margin} = \frac{\text{trailing earnings}}{\text{sales}} = \frac{E_0}{S}$$

so

$$\text{trailing P/E} = \frac{P/S}{E_0/S} = \frac{P/S}{\text{net profit margin}}$$

$$\text{trailing P/E} = \frac{P/S}{\text{net profit margin}} = \frac{2.0}{0.05} = 40$$

$$\text{leading P/E} = \frac{\text{trailing P/E}}{1+g} = \frac{40}{1.04} = 38.5$$

(LOS 22.b)

3. **A** Copyright's justified leading P/E multiple using the valuation from the H-model is \$84 / \$4.20 = 20 times. The firm is underpriced if its actual P/E is less than 20; it is overpriced if its actual P/E is greater than 20. (LOS 22.a)

Module Quiz 22.2, 22.3, 22.4

1. **C** Profit margin is measured as E/S. In this example, the profit margin is \$5.35 / \$342 = 0.0156. Thus:

$$\frac{P_0}{S_0} = \frac{0.0156 \times 0.75 \times 1.045}{0.150 - 0.045} = 0.1164 \text{ times}$$

(Module 22.3, LOS 22.i)

2. **C**

$$\text{book value / share} = \frac{\text{book value of equity}}{\text{number of shares outstanding}} = \frac{\$19{,}950}{6{,}162} = \$3.238$$

$$P/B = \frac{\text{market price per share}}{\text{book value per share}} = \frac{\$31.37}{\$3.238} = 9.688$$

$$\text{sales/share} = \frac{\text{sales}}{\text{number of shares outstanding}} = \frac{\$32{,}373}{6{,}162} = \$5.254$$

$$P/S = \frac{\text{market price per share}}{\text{sales per share}} = \frac{\$31.37}{\$5.254} = 5.971$$

(Module 22.3, LOS 22.b)

3. **A** $$\text{book value/share} = \frac{\text{book value of equity}}{\text{number of shares outstanding}}$$

$$= \frac{\$61{,}020}{10{,}771} = \$5.665$$

$$\text{P/B} = \frac{\text{market price per share}}{\text{book value per share}} = \frac{\$25.63}{\$5.665} = 4.524$$

$$\text{sales/share} = \frac{\text{sales}}{\text{number of shares outstanding}} = \frac{\$32{,}187}{10{,}771} = \$2.988$$

$$\text{P/S} = \frac{\text{market price per share}}{\text{sales per share}} = \frac{\$25.63}{\$2.988} = 8.578$$

(Module 22.3, LOS 22.b)

4. **A** Both stocks are relatively overvalued. The P/B and P/S ratios for Pfeiffer are 9.688 and 5.971. The P/B ratio for Pfeiffer exceeds the mean P/B ratio for the peer group (5.622) as well as the median P/B ratio (4.250) for the peer group, and therefore, by this measure, the stock would appear to be overvalued.

The P/S ratio also exceeds the median P/S (4.530) for the peer group, which further suggests that the stock is relatively overvalued. The P/B and P/S ratios for Mapps are 4.524 and 8.578. The P/B ratio for Mapps is greater than the mean P/B ratio for the peer group (4.100), and Mapps's P/B ratio exceeds the median ratio (2.140) for the peer group, and therefore, by this measure, Mapps is overvalued. Mapps's P/S ratio exceeds both the mean P/S (3.420) and the median P/S (1.440) for the peer group. The P/S ratio also indicates that Mapps is relatively overvalued. (Module 22.3, LOS 22.l)

5. **A** Home Decor appears to be undervalued relative to Lester's. This conclusion is based on the fact that (1) Home Decor is selling at a P/CF of 20.88, which is 87.4% of the P/CF for Lester's (23.90), and (2) the P/FCFE for Home Decor (28.69) is 21.6% of the P/FCFE for Lester's (132.78). We would expect that Home Decor would have a higher P/CF because of its higher expected growth. However, because P/CF is actually lower, this is an indication that Home Decor is undervalued relative to Lester's. (Module 22.3, LOS 22.l)

6. **C** In the home improvement segment of the retail industry, Home Decor appears to be a more attractive investment than Lester's for the following reasons:

- Home Decor is trading at a P/B that is 91% of the average P/B for the home improvement segment of the retail industry, with a forecasted ROE that is the same as that of the industry. This indicates that Home Decor is undervalued relative to its industry.
- Home Decor is currently trading at a P/B that is 76.6% of the P/B for Lester's, with an estimated ROE that is slightly greater than the forecasted ROE for Lester's. This indicates that Home Decor is undervalued relative to Lester's.
- Lester's is trading at a P/B that is 119% of the industry average P/B, with a forecasted ROE that is slightly below the industry's forecasted ROE. This indicates that Lester's is overvalued relative to its industry.
- It should be noted that Home Decor's higher beta may account for Home Decor's low P/B and high forecast ROE relative to Lester's.

(Module 22.3, LOS 22.l)

7. **A** In the department and discount segment of the retail industry, Harmon's appears to be a more attractive investment than Wally's for the following reasons:
   - Harmon's is trading at a P/B that is 57% of the average P/B for the department and discount store segment of the retail industry with a forecasted ROE that is very close to that of the industry. This indicates that Harmon's is undervalued relative to the industry.
   - Harmon's is currently trading at a P/B that is 50% of the current P/B for Wally's, with an estimated ROE that is just slightly less than the forecasted ROE for Wally's. This indicates that Harmon's is undervalued relative to Wally's. It should be noted that the beta values for Harmon's and Wally's are only slightly different, indicating similar risk.
   - Wally's is trading at a P/B that is 114% of the industry average P/B, with a forecasted ROE that is only slightly above the ROE forecast for the industry. This indicates that Wally's is overvalued relative to its industry.

   (Module 22.3, LOS 22.l)

8. **B** P = $42.10/share

   CF = net income + depreciation = $1,023,262,000 + $534,102,000 = $1,557,364,000

   number of basic shares outstanding = 631,643,000

   CF/share = $1,557,364,000 / 631,643,000 = $2.4656

   P/CF = $42.10 / $2.4656 = 17.08 times

   (Module 22.3, LOS 22.n)

9. **B** It is appropriate to make one adjustment to CFO in this problem to reflect nonrecurring items:
   - The nonrecurring expense of $139,870,000 that appears on the income statement should be added back after adjusting for taxes.

   CFO (reflecting nonrecurring items) = $1,497,442,000 + $139,870,000(1 – 0.37) = $1,585,560,100

   adjusted CFO per share = $1,585,560,100 / 631,643,000 = $2.51

   adjusted P/CFO = $42.10 / $2.51 = 16.77 or closest to 17

   (Module 22.3, LOS 22.n)

10. **B** underlying earnings = $1.29 + $0.22 + $0.04 – $0.08 = $1.47

    $$\text{P/E ratio} = \frac{\$42.50}{\$1.47} = 28.9$$

    (Module 22.4, LOS 22.e)

11. **A** Only the average ROE and the book value per share are relevant for calculating normalized earnings:

    $$\begin{aligned}\text{normalized earnings} &= \text{average ROE} \times \text{BVPS} = 0.32 \times \$14 \\ &= \$4.48 \text{ per share}\end{aligned}$$

    (Module 22.4, LOS 22.e)

12. **C** Dividend yield is positively related to the required rate of return and negatively related to the forecasted growth rate in dividends. Thus, choosing high dividend

yield stocks reflects a value- rather than a growth-style orientation. (Module 22.4, LOS 22.g)

13. **A** predicted P/E = 8.57 + (5.38 × 0.65) + (15.53 × 0.032) – (0.61 × 0.56) = 12.2

(Module 22.4, LOS 22.h)

14. **A**

$$\text{trailing P/E} = \frac{P_0}{E_0} = \frac{(1-b)\times(1+g)}{r-g} = \frac{\left(\frac{\$0.40}{\$1.00}\right)\times 1.05}{0.12-0.05} = 6.0$$

$$\text{leading P/E} = \frac{P_0}{E_1} = \frac{1-b}{r-g} = \frac{0.40}{0.12-0.05} = 5.7$$

(Module 22.4, LOS 22.i)

15. **C** Based on the fundamentals:

$$\frac{P_0}{B_0} = \frac{0.23-0.076}{0.14-0.076} = 2.41$$

(Module 22.4, LOS 22.i)

16. **B** The firm's PEG is 18.75 / 15.32 = 1.22. Given the comparable group median PEG of 0.92, it appears that Party Favors, Inc., may be overvalued. (Module 22.4, LOS 22.j)

17. **A** EBITDA = net income + interest expense + taxes + depreciation + amortization

= 119.4 + 5.8 + 85.9 + 6.9 + 2.3 = $220.3 million

EV = (share price × shares outstanding) + market value of debt – cash and marketable securities – investments

= (31.25 × 30) + 115 – 47.6 – 247 = $757.9 million

$$\text{EV/EBITDA} = \frac{\$757.9}{\$220.3} = 3.44$$

(Module 22.4, LOS 22.o)

READING 23

RESIDUAL INCOME VALUATION

EXAM FOCUS

This topic review introduces the fourth type of valuation model found in the CFA curriculum: Residual income models. You should understand the differences between these models and the dividend discount, free cash flow, and market multiple models. The successful application of residual income models depends on making the appropriate adjustments to the financial statements, so you also should be able to use the techniques you learned in the Financial Statement Analysis material in applying these models. The concept of continuing residual income is also related to the material on industry analysis in FSA. With all these links to other concepts in the Level II curriculum, this material is highly testable.

MODULE 23.1: RESIDUAL INCOME DEFINED

Video covering this content is available online.

LOS 23.a: Calculate and interpret residual income, economic value added, and market value added.

Residual income (RI), or economic profit, is the net income of a firm less a charge that measures stockholders' opportunity cost of capital. The rationale for the residual income approach is that it recognizes the cost of equity capital in the measurement of income. This concept of economic income is not reflected in traditional accounting income, whereby a firm can report positive net income but not meet the return requirements of its equity investors. Accounting net income includes a cost of debt (i.e., interest expense), but does not reflect dividends or other equity capital-related funding costs. This means that accounting income may overstate returns from the perspective of equity investors. Conversely, residual income explicitly *deducts all capital costs*.

EXAMPLE: Calculating residual income

Madeira Fruit Suppliers, Inc., (MFS) distributes fruit to grocery stores in large U.S. cities. The book value of its assets is $1.4 billion, which is financed with $800 million in equity and $600 million in debt. Its before-tax cost of debt is 3.33%, and its marginal tax rate is 34%. MFS has a cost of equity of 12.3%. MFS's abbreviated income statement is shown in the following figure.

Partial Income Statement for MFS

EBIT	$142,000,000
Less: Interest expense	(20,000,000)
Pretax income	122,000,000
Less: Income tax expense	(41,480,000)
Net income	$80,520,000

Determine whether MFS is profitable by calculating residual income and explaining its relationship to reported accounting income.

Answer:

While the accounting net income of $80,520,000 indicates that MFS is profitable, it remains to be seen whether the firm is profitable after deducting a charge for equity. The dollar-based equity charge is:

$$\begin{aligned}\text{equity charge} &= \text{equity capital} \times \text{cost of equity} = \$800 \text{ million} \times 0.123 \\ &= \$98,400,000\end{aligned}$$

RI is calculated as:

Net income	$80,520,000
− Equity charge	98,400,000
Residual income	−$17,880,000

Even though MFS is profitable in the traditional accounting sense, it is economically unprofitable after taking into account the necessary charge to meet stockholders' opportunity cost of supplying capital to the company.

EVA and MVA

Economic value added (EVA®) measures the value added for shareholders by management during a given year. EVA is calculated as:

$$\begin{aligned}\text{EVA} &= \text{NOPAT} - (\text{WACC} \times \text{total capital}) \\ &= [\text{EBIT} \times (1 - t)] - \$\text{WACC}\end{aligned}$$

where:

NOPAT	= net operating profit after tax
WACC	= after-tax weighted average cost of capital in decimal terms (e.g., 0.05)
t	= marginal tax rate
$WACC	= dollar cost of capital
total capital	= net working capital + net fixed assets = book value of long-term debt + book value of equity

PROFESSOR'S NOTE

Notice the difference in calculation between residual income and EVA. Residual income is net income (after subtracting interest expense) minus a charge for equity capital based on the cost of equity. EVA is NOPAT (before subtracting interest expense minus a charge for debt and equity capital based on the WACC). Conceptually, however, they are both measuring economic income. For the purpose of EVA computation, we use beginning-of-year total

capital. Market value added (discussed later) uses end-of-year (the same point at which market value is determined) total capital.

The analyst should make the following adjustments (if applicable) to the financial statements before calculating NOPAT and invested capital:

- Capitalize and amortize research and development charges (rather than expense them), and add them back to earnings to calculate NOPAT.
- Add back charges on strategic investments that will generate returns in the future.
- Eliminate deferred taxes and consider only cash taxes as an expense.
- Treat operating leases as capital leases and adjust nonrecurring items.
- Add LIFO reserve to invested capital and add back change in LIFO reserve to NOPAT.

Market value added (MVA) is the difference between the market value of a firm's long-term debt and equity and the book value of invested capital supplied by investors. It measures the value created by management's decisions since the firm's inception. MVA is calculated as:

MVA = market value − total capital

EXAMPLE: Calculating EVA and MVA

VBM, Inc., reports NOPAT of $2,100, a WACC of 14.2%, and invested capital of $18,000 at the beginning of the year and $21,000 at the end of the year. The market price (year-end) of the firm's stock is $25 per share, and VBM has 800 shares outstanding. The market value (year-end) of the firm's long-term debt is $4,000. Calculate VBM's EVA and MVA.

Answer:

First calculate EVA:

$WACC = 0.142 × $18,000 = $2,556

EVA = $2,100 − $2,556 = −$456

The market value of the company is the market value of the equity plus the market value of the debt:

MV of company = ($25 × 800) + $4,000 = $24,000

The firm's MVA is:

MVA = $24,000 − $21,000 = $3,000

LOS 23.b: Describe the uses of residual income models.

There are several commercially available residual income-based valuation models. It is interesting to note that these models, like EVA and MVA, usually apply the concept of residual income to the measurement of managerial effectiveness and executive compensation. However, for the exam we're most interested in the equity

valuation applications of residual income models. Residual income models have also been proposed as a method to measure goodwill impairment.

MODULE 23.2: RESIDUAL INCOME COMPUTATION

Video covering this content is available online.

LOS 23.c: Calculate the intrinsic value of a common stock using the residual income model and compare value recognition in residual income and other present value models.

We can forecast residual income given some basic accounting information and an estimate of future earnings growth using the following formula:

$$RI_t = E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$$

where:

RI_t = residual income per share in year t
E_t = expected EPS for year t
r = required return on equity
B_{t-1} = book value per share in year t − 1
ROE = expected return on new investments (expected return on equity)

EXAMPLE: Forecasting residual income

Laura Kraft, CFA, was assigned the task of forecasting the residual income for Delilah Cosmetics, Inc., over the next two years. To accomplish this task, Kraft assembled the information provided in the following figure. Kraft used a required rate of return of 11%. Forecast Delilah's residual income for 2025 and 2026.

Delilah Data Forecast

Current market price	**€24.00**
Current book value per share (December 31, 2024)	€18.00
Consensus annual EPS estimates	
December 31, 2025	€2.05
December 31, 2026	€2.22
Dividend payout ratio 2025 and 2026	65%

Answer:

Delilah Residual Income Forecast

	FY 2025	FY 2026
Beginning book value (B_{t-1})	€18.00	€18.72
Earnings per share forecast (E_t)	2.05	2.22
Dividend forecast ($D_t = E_t \times$ payout ratio)	1.33	1.44
Forecast book value per share ($B_{t-1} + E_t - D_t$)	18.72	19.50
Equity charge per share ($r \times B_{t-1}$)	1.98	2.06
Per share RI_t [$E_t - (r \times B_{t-1})$]	€0.07	€0.16

The residual income valuation model breaks the intrinsic value of a stock into two elements: (1) current book value of equity and (2) present value of expected *future* residual income:

$$V_0 = B_0 + \left\{ \frac{RI_1}{(1+r)^1} + \frac{RI_2}{(1+r)^2} + \frac{RI_3}{(1+r)^3} + \dots \right\}$$

where:
B_0 = current book value of equity
RI_t = $E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$
r = required return on equity
ROE = expected return on new investments (expected return on equity)

Don't let this formula intimidate you! All the above expression really says is that a stock's intrinsic value, V_0, is equal to its current book value per share, B_0, plus the present value of all its expected future residual income, which is the difference between end-of-period earnings and equity charges based on beginning-of-period book value.

The difficulty in implementing this model is that we have to make some assumptions about the pattern of residual income growth in the future because it's difficult to take the present value of an infinite stream of residual incomes without more restrictive assumptions. In the following example, we make it easy by assuming the company ceases operations at the end of three years, so we only have three residual income forecasts to discount back.

EXAMPLE: Computing intrinsic value with a residual income model

Consolidated Pipe Products has a required rate of return of 14%. The current book value is C$6.50. Earnings forecasts for 2025, 2026, and 2027 are C$1.10, C$1.00, and C$0.95, respectively. Dividends in 2025 and 2026 are forecasted to be C$0.50 and C$0.60, respectively. The dividend in 2027 is a liquidating dividend, which means that Consolidated will pay out its entire book value in dividends and cease doing business at the end of 2027. Calculate the value of Consolidated's stock using the residual income model.

Answer:

The residual income forecast is shown in the following table, with calculated values in blue.

Consolidated Pipe Residual Income Forecast

	2025	2026	2027
Beginning book value per share (B_{t-1})	C$6.50	**C$7.10**	**C$7.50**
Earnings per share forecast (E_t)	1.10	1.00	0.95
Dividends per share forecast (D_t)	0.50	0.60	**8.45**
Forecast book value per share ($B_{t-1} + E_t - D_t$)	7.10	7.50	0.00
Equity charge per share ($r \times B_{t-1}$)	**0.91**	**0.99**	**1.05**
Per share RI [$E_t - (r \times B_{t-1})$]	**C$0.19**	**C$0.01**	**–C$0.10**

The intrinsic value of Consolidated Pipe Products is its current book value plus the present value of the future residual income forecasts:

$$V_0 = \text{C\$6.50} + \frac{\text{C\$0.19}}{1.14^1} + \frac{\text{C\$0.01}}{1.14^2} - \frac{\text{C\$0.10}}{1.14^3} = \text{C\$6.61}$$

We can also use the cash flow function on our calculators to solve this problem and save ourselves a little time. Here are the keystrokes:

$CF_0 = 6.50$; C01 = 0.19; C02 = 0.01; C03 = –0.10; I = 14;
CPT → NPV = 6.61

Value tends to be recognized earlier in the RI approach than in other present value-based approaches. To see this, recall that with a dividend discount model (DDM) or free cash flow to equity (FCFE) model, a large portion of the estimated intrinsic value comes from the present value of the expected terminal value. Yet the uncertainty of the expected terminal value is usually greater than any of the other forecasted cash flows because it occurs several years in the future. Valuation with residual income models, however, is relatively less sensitive to terminal value estimates, which reduces forecast error. This is because intrinsic values estimated with residual income models include the firm's current book value (which is known and doesn't need to be forecasted), and the current book value usually represents a substantial percentage of the estimated intrinsic value.

LOS 23.d: Explain fundamental determinants of residual income.

The general residual income models make no assumptions regarding the long-term future earnings or dividend growth. However, if we make the simplifying assumption of a constant dividend and earnings growth rate, we can develop a residual income model that highlights the fundamental drivers of residual income. Assuming the stock is correctly priced (i.e., $P_0 = V_0$), value can be expressed in terms of book value:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$

This model is actually just another version of the Gordon growth model, so if you can use the same inputs, both models will give you the same value estimates.

This version of the residual income model is referred to as the **single-stage residual income valuation model**. In this formulation (assuming constant earnings and dividend growth) the first term is the current book value, the value of the company's assets net of liabilities. The second term in brackets is the present value of the expected future residual income. We can use this relationship to identify the **fundamental drivers** of residual income:

- If return on equity (ROE) is equal to the required return on equity, the justified market value of a share of stock is equal to its book value. When ROE is higher than the required return on equity, the firm will have positive residual income and will be valued at more than book value.
- $\left[\frac{(ROE - r) \times B_0}{r - g}\right]$ is the additional value generated by the firm's ability to produce returns in excess of the cost of equity and, consequently, is the present value of a firm's expected economic profits (i.e., residual income).

Tobin's Q is a related concept:

$$Q = \frac{\text{market value of debt + market value of equity}}{\text{replacement cost of total assets}}$$

PROFESSOR'S NOTE

The single-stage model assumes constant ROE and constant earnings growth, which implies that residual income will persist indefinitely. Residual income is likely to approach zero over time, however, as competitive forces drive industry profit margins to normal levels. Thus, in practice, the single-stage model is modified to handle declining RI by forecasting continuing residual income.

LOS 23.e: Explain the relation between residual income valuation and the justified price-to-book ratio based on forecasted fundamentals.

As with the DDM and FCFE models, residual income models can be used to estimate justified price multiples. Among the various market multiples, residual income models are most closely related to the price-to-book value (P/B) ratio because the justified P/B is directly linked to expected future residual income. This can be seen by observing the single-stage model. If ROE is greater than the required return on equity, the second term (the present value of residual income) will be positive, the market value will be greater than book value, and the justified P/B ratio will be greater than one.

MODULE QUIZ 23.1, 23.2

1. The present value of Sporting Shoes (SS) projected residual income for the next five years plus beginning book value is C$75.00 per share. Beyond that time horizon, the firm will sustain a residual income of C$11.25 per share, which is the residual income for Year 6. The cost of equity is 10%. The justified value of SS's common stock is *closest* to:
   A. C$69.85.
   B. C$112.50.
   C. C$144.85.

MODULE 23.3: CONSTANT GROWTH MODEL FOR RI

Video covering this content is available online.

LOS 23.f: Calculate and interpret the intrinsic value of a common stock using single-stage (constant-growth) and multistage residual income models.

EXAMPLE: Calculating value with a single-stage residual income model

Western Atlantic Railroad has a book value of $23.00 per share. The company's return on new investments (ROE) is 14%, and its required return on equity is 12%. The dividend payout ratio is 60%. Calculate the value of the shares using a single-stage residual income model and the present value of expected economic profits.

Answer:

First, calculate the growth rate:

g = retention ratio × ROE = (1 − 0.6) × 0.14 = 0.056 = 5.6%

Then, calculate intrinsic value using the single-stage model:

$$V_0 = \$23.00 + \left[\frac{(0.14 - 0.12) \times \$23.00}{0.12 - 0.056}\right] = \$23.00 + \$7.19 = \$30.19$$

The present value of the firm's expected economic profits is $7.19.

EXAMPLE: Western Atlantic Railroad valuation with Gordon growth model

Use the information in the previous example to calculate the value of Western Atlantic common stock using the Gordon growth model.

Answer:

Earnings in Year 1 (E_1) is equal to beginning book value multiplied by ROE: E_1 = $23.00 × 0.14 = $3.22. With a dividend payout ratio of 60%, D_1 = $3.22 (0.6) = $1.932. Then, using the Gordon growth model:

$$V_0 = \frac{\$1.932}{0.12 - 0.056} = \$30.19$$

Notice that this is the same estimate as in the previous example where we used the single-stage residual income model.

PROFESSOR'S NOTE

Multistage residual income models will be discussed in a later LOS.

LOS 23.g: Calculate the implied growth rate in residual income, given the market price-to-book ratio and an estimate of the required rate of return on equity.

We can rearrange the single-stage residual income valuation model and solve for the growth rate in terms of the other variables:

$$g = r - \left[\frac{B_0 \times (ROE - r)}{V_0 - B_0}\right]$$

This expression can now be used to directly compute the market's expectations of residual income growth implied by the current market price under the assumption that intrinsic value is equal to market price.

EXAMPLE: Calculating implied growth rate

You are considering the purchase of Tellis Telecommunications, Inc., which has a P/B ratio of 2.50. ROE is expected to be 13%, current book value per share is €8.00, and the cost of equity is 11%. Calculate the growth rate implied by the current P/B ratio.

Answer:

The P/B ratio of 2.50 and the current book value per share of €8.00 imply a current market price of €20.00(8 × 2.50). This implies a growth rate of:

$$g = 0.11 - \left[\frac{€8.00 \times (0.13 - 0.11)}{€20.00 - €8.00}\right] = 0.0967 = 9.67\%$$

MODULE QUIZ 23.3

1. Jill Smart is an analyst with Allenton Partners. Jill is reviewing the valuation of three companies (P, Q, and R) using the residual income model and their corresponding current market prices.

   The information below summarizes the findings:

	Stock		
	P	Q	R
Market price	35	40	38
Residual income model value	40	35	38

   Based on the above information, which statement *best* describes the market's valuation of P, Q, and R?

   A. P is overvalued, Q is undervalued, and R is fairly valued.
   B. P is undervalued, Q is fairly valued, and R is overvalued.
   C. P is undervalued, Q is overvalued, and R is fairly valued.

2. An investor is considering the purchase of Capital City Investments, Inc., which has a price-to-book value (P/B ratio) of 5.00. Return on equity (ROE) is expected to be 18%, the market price per share is $25.00, and the growth rate is expected to be 8%. Assume the shares are currently priced at their fair value. The cost of equity implied by the current P/B ratio is *closest* to:

   A. 12%.
   B. 16%.
   C. 10%.

3. Century Scales has a required return on equity of 12% and is expected to grow indefinitely at a rate of 5%. The expected return on equity (ROE) that would justify a price-to-book multiple of 2.14 is *closest* to:

   A. 10%.
   B. 15%.

C. 20%.

4. Marg Myers, CFA, has determined that Rocky Romano Ice Cream Company can be valued using a single-stage residual income model. Myers estimates Rocky's return on equity (ROE) is greater than the cost of equity capital, which is greater than the sustainable growth rate. Book value per share is greater than zero. What can Myers conclude about Rocky's present value (PV) of future expected residual income (RI) and Rocky's justified price-to-book ratio?

	PV of expected RI	Justified price-to-book ratio
A.	Greater than zero	Greater than one
B.	Less than zero	Greater than one
C.	Greater than zero	Less than one

5. Krackel, Inc., has a book value per share as of FYE 2023 of $4.50. The required return on equity is 10%. Earnings per share in 2024 are forecast to be $0.45. Assume Krackel can be valued using a single-stage residual income model. The justified price-to-book ratio and the present value of expected residual income are *closest* to:

	Justified price-to-book ratio	PV of expected RI
A.	1.0	$0.00
B.	1.45	$0.00
C.	1.45	$4.05

MODULE 23.4: CONTINUING RESIDUAL INCOME

Video covering this content is available online.

LOS 23.h: Explain continuing residual income and justify an estimate of continuing residual income at the forecast horizon, given company and industry prospects.

Previously, we mentioned the problem of forecasting residual income indefinitely into the future, which makes it difficult to calculate the present value of residual income and implement the residual income model. However, we can simplify the model by using the same multistage approach we used for DDM and free cash flow models. We'll forecast residual income over a short-term horizon (e.g., five years) and then make some simplifying assumptions about the pattern of residual income growth over the long term after five years. **Continuing residual income** is the residual income that is expected over the long term.

Residual income will continue beyond a specified earnings horizon depending on the fortunes of the industry, as well as on the sustainability of a specific firm's competitive prospects over the longer term. The projected rate at which residual income is expected to fade over the life cycle of the firm is captured by a **persistence factor**, ω, which is between zero and one.

To simplify the model, we typically make one of the following assumptions about continuing residual income at the end of the short-term period:

- Residual income is expected to persist at its current level forever.
- Residual income is expected to drop immediately to zero.
- Residual income is expected to decline over time as ROE falls to the cost of equity (in which case residual income is eventually zero).

- Residual income is expected to decline to a long-run average level consistent with a mature industry.

An analysis of the firm's position in its industry and the structure of the industry will be necessary to justify one of these assumptions. The third scenario is the most realistic if we assume that over time, industry competition reduces economic profits to the point at which firms begin to leave the industry and ROE stabilizes at a long-run normal level. The strength of the persistence factor will depend partly on the sustainability of the firm's competitive advantage and the structure of the industry. The more sustainable the competitive advantage and the better the industry prospects, the higher the persistence factor.

Higher persistence factors will be associated with the following:

- Low dividend payouts.
- Historically high residual income persistence in the industry.

Lower persistence factors will be associated with the following:

- High return on equity.
- Significant levels of nonrecurring items.
- High accounting accruals.

Think of the continuing residual income model as a multistage model similar to the multistage DDM and FCF models from earlier in the Equity materials. In the residual income model, intrinsic value is the sum of three components:

$V_0 = B_0 +$ (PV of interim high-growth RI) + (PV of continuing residual income)

Step 1: Calculate the current book value per share.

Step 2: Calculate residual income in each year 1 to T − 1 during the interim high-growth period and discount them back to today at the required return on equity.

Step 3: Calculate continuing residual income that begins at the end of the high-growth period starting in year T, and then calculate the present value of continuing residual income as of the end of year T − 1 using the following formula:

$$\text{PV of continuing residual income in year } T-1 = \frac{RI_T}{1+r-\omega}$$

where:
ω = persistence factor, $0 \leq \omega \leq 1$

Assumption #1: Residual Income Persists at the Current Level Forever

If $\omega = 1$, residual income is expected to persist at the current level forever after year T − 1, so residual income in every year after T equals residual income in year T. The present value of continuing residual income at the end of year T − 1 is the present value of a perpetuity:

$$\text{PV of continuing residual income in year } T-1 = \frac{RI_T}{1+r-\omega} = \frac{RI_T}{1+r-1} = \frac{RI_T}{r}$$

Assumption #2: Residual Income Drops Immediately to Zero

If $\omega = 0$, residual income is expected to drop immediately to zero beginning in year T + 1, and the present value of continuing residual income in year T − 1 is:

$$\text{PV of continuing residual income in year T} - 1 = \frac{RI_T}{1 + r - \omega} = \frac{RI_T}{1 + r - 0} = \frac{RI_T}{1 + r}$$

Assumption #3: Residual Income Declines Over Time to Zero

If residual income is expected to decline over time after year T as ROE falls to the cost of equity capital, then the persistence factor, ω, is between zero and one, and the present value of continuing residual income in year T − 1 is equal to:

$$\text{PV of continuing residual income in year T} - 1 = \frac{RI_T}{1 + r - \omega}$$

Assumption #4: Residual Income Declines to Long-Run Level in Mature Industry

There is another, simpler approach to calculating the PV of continuing residual income that does not rely on the formula or ω, the persistence factor, if residual income is expected to decline to a normal long-run level consistent with a mature industry after year T.

First, recall from the single-stage residual income model that market value equals book value plus the present value of residual income. Therefore, at any point in time (T), the present value of future residual income is the difference between market value (P_T) and book value (B_T):

$$\text{PV of continuing residual income in year T} = P_T - B_T$$

How do we estimate P_T?

Given a forecasted price-to-book ratio and book value at the end of the year T, the value of the stock is:

$$P_T = B_T \times \text{(forecasted price-to-book ratio)}$$

To make this approach consistent with the first three that use the persistence factor equation, we can also calculate the present value of continuing residual income at time T − 1:

$$\text{PV of continuing residual income in year T} - 1 = \frac{(P_T - B_T) + RI_T}{1 + r}$$

EXAMPLE: Calculating value with a multistage residual income model (part 1)

Java Metals is expecting an ROE of 15% over each of the next five years. Its current book value is $5.00 per share, it pays no dividends, and all earnings are reinvested. The required return on equity is 10%. Forecasted earnings in Years 1 through 5 are equal to ROE times beginning book value. Calculate the intrinsic value of the company using a residual income model, assuming that after five years, continuing residual income falls to zero.

Answer:

The following table provides an estimate of the present value of residual income.

Java Metals Residual Income Forecast

Year t	E_t	Ending Book Value (B_t)	ROE	Equity Charge ($r \times B_{t-1}$)	Residual Income [$E - (r \times B_{t-1})$]
0		$5.00			
1	$0.75	5.75	0.15	$0.50	$0.25
2	0.86	6.61	0.15	0.57	0.29
3	0.99	7.60	0.15	0.66	0.33
4	1.14	8.74	0.15	0.76	0.38
5	1.31	10.05	0.15	0.87	0.44

Under the assumption that residual income after five years is zero (i.e., $\omega = 0$), intrinsic value today is:

$$V_0 = \$5.00 + \left[\frac{\$0.25}{1.10} + \frac{\$0.29}{1.10^2} + \frac{\$0.33}{1.10^3} + \frac{\$0.38}{1.10^4} + \frac{\$0.44}{1.10^5}\right] = \$6.25$$

Remember, you can also use your calculator to solve for the answer: CF0 = 5, C01 = 0.25, C02 = 0.29, C03 = 0.33, C04 = 0.38, C05 = 0.44, I = 10, CPT → NPV = $6.25.

EXAMPLE: Calculating value with a multistage residual income model (part 2)

Suppose we change our assumption regarding Java's residual income after five years to assume instead that it remains constant at $0.44 forever. Calculate the new intrinsic value of Java.

Answer:

The intrinsic value of Java is higher than the first case because we assume the residual income persists at the same level forever, so $RI_5 = RI_6 = \ldots = \$0.44$, and $\omega = 1$. The $0.44 perpetuity beginning in Year 5 is worth $4.40 ($0.44/0.10) in Year 4. The intrinsic value is:

$$V_0 = \$5.00 + \left[\frac{\$0.25}{1.10} + \frac{\$0.29}{1.10^2} + \frac{\$0.33}{1.10^3} + \frac{\$0.38 + \$4.40}{1.10^4}\right] = \$8.98$$

EXAMPLE: Calculating value with a multistage residual income model (part 3)

Now let's make the more realistic assumption that after Year 5, Java's residual income will decay over time to zero with a persistence factor of 0.4. Calculate the new intrinsic value of Java.

Answer:

Residual income begins to decline after Year 5, so the terminal value in Year 4 includes the present value of Year 5 residual income.

$$\text{terminal value in Year 4} = \frac{RI_5}{1 + r - \omega} = \frac{\$0.44}{1 + 0.10 - 0.40} = \$0.63$$

The intrinsic value today is book value plus the present value of Years 1 through 4 residual income plus the present value of the terminal value in Year 4.

$$V_0 = \$5.00 + \left[\frac{\$0.25}{1.10} + \frac{\$0.29}{1.10^2} + \frac{\$0.33}{1.10^3} + \frac{\$0.38 + \$0.63}{1.10^4}\right] = \$6.40$$

Notice that the more conservative assumption of a lower persistence factor reduces the intrinsic value of the stock because the firm's competitive advantage and economic profits eventually disappear.

EXAMPLE: Calculating value with a multistage residual income model (part 4)

Suppose instead that at the end of Year 5 we assume that Java's ROE falls to a long-run average level and the price-to-book ratio falls to 1.2. Calculate Java's intrinsic value.

Answer:

The book value per share at the end of Year 5 is \$10.05, which means the market price is expected to be \$10.05 × 1.2 = \$12.06. The present value of continuing residual income is:

PV of continuing residual income in Year 4

$$= \frac{(P_T - B_T) + RI_T}{1 + r} = \frac{(\$12.06 - \$10.05) + \$0.44}{1.10}$$

$$= \frac{\$2.45}{1.10} = \$2.23$$

Then intrinsic value is:

$$V_0 = \$5.00 + \left[\frac{\$0.25}{1.10} + \frac{\$0.29}{1.10^2} + \frac{\$0.33}{1.10^3} + \frac{\$0.38 + \$2.23}{1.10^4}\right] = \$7.50$$

PROFESSOR'S NOTE

If a stock is trading at a price (market price) higher than the price implied by the residual income model (model price), the stock is considered to be **overvalued**. Similarly, if the market price is lower than the model price, the stock is considered to be **undervalued**, and if the model price is equal to the market price, the stock is considered to be **fairly valued**.

MODULE QUIZ 23.4

1. Meyer Henderson, CFA, estimates the value of Trammel Medical Supplies to be \$68 per share using a residual income model. In his estimate of continuing residual income, he assumes that, after Year 6, residual income will persist at the same level forever. How many of the following assumptions concerning residual income would *most likely* cause his value estimate to fall below \$68?

Assumption #1: Return on equity is expected to fall immediately to Trammel's cost of equity capital.

Assumption #2: Return on equity is expected to fall over time to Trammel's cost of equity capital with a persistence factor of 0.2.

Assumption #3: Return on equity is expected to fall over time to the long-run industry average.

A. One.
B. Two.
C. Three.

Use the following information to answer Questions 2 and 3.

Josef Robien, CFA, is valuing the common stock of British Cornucopia Bank (BCB) as of December 31, 2023, when the book value per share is £10.62. In this effort, Robien has made the following assumptions:

- Earnings per share (EPS) will be 20% of the beginning book value per share for each of the next three years.
- BCB will pay cash dividends equal to 40% of EPS.
- At the end of three years, BCB's common stock will trade at four times its book value.
- Beta for BCB is 0.7, the risk-free rate is 4.5%, and the equity risk premium is 5.0%.

2. The residual income per share in 2026 and the present value of continuing residual income as of the end of 2025 are *closest* to:

	2026 residual income	Continuing residual income
A.	£1.43	£42.89
B.	£1.59	£42.89
C.	£1.59	£59.64

3. The value per share of BCB stock using the residual income model is *closest* to:
   A. £39.17.
   B. £49.80.
   C. £53.20.

Use the following information to answer Questions 4 through 6.

Aaron Mechanic, CFA, is responsible for valuing the shares of Duotronics Research Laboratories (DRL). The stock is currently trading at €8.75, and Mechanic gathers the following financial information about the company:

- Expected return on equity (ROE) = 16% annually for each of the next four years.
- Current book value (BV) of equity = €435,000,000.
- Shares outstanding: 60 million.
- Required rate of return on equity = 12%.
- No dividends paid.
- All earnings are reinvested.
- Continuing residual income = 0 after four years.

4. Based on the residual income model, the intrinsic value and the *most likely* recommendation Mechanic would issue for the stock of DRL are:

	Intrinsic value	Recommendation
A.	€1.10	Sell
B.	€8.34	Buy
C.	€8.34	Sell

5. Mechanic is considering revising his expectation of the continuing residual income after the 4-year horizon period and believes that it will remain constant at the Year 4 forecast level of residual income for the foreseeable future. Based on the residual income model, the intrinsic value and the *most likely* recommendation Mechanic would issue for the stock of DRL are:

	Intrinsic value	Recommendation
A.	€8.75	Buy
B.	€10.73	Buy
C.	€10.73	Sell

6. George Karanopoulos, CFA, is Mechanic's immediate supervisor. He believes that Mechanic's assumption of constant residual income after the initial forecast period is unrealistic. He has suggested that Mechanic re-estimate the value of DRL based on a persistence factor of $\omega = 0.3$ after Year 4. Based on the residual income model, the intrinsic value and the *most likely* recommendation Mechanic would issue for the stock of DRL are:

	Intrinsic value	Recommendation
A.	€8.95	Sell
B.	€8.45	Buy
C.	€8.45	Sell

MODULE 23.5: STRENGTHS/WEAKNESSES

Video covering this content is available online.

LOS 23.i: Compare residual income models to dividend discount and free cash flow models.

DDM and FCFE models measure value by discounting a stream of expected cash flows. The residual income model starts with a book value and adds to this the present value of the expected stream of residual income. Theoretically, the intrinsic value derived using expected dividends, expected free cash flow to equity, or book value plus expected residual income should be identical if the underlying assumptions used to make the necessary forecasts are the same. In reality, however, it is rarely possible to forecast all of the common inputs with the same degree of accuracy, and the different models yield different results. It may be helpful though, to use a residual income model alongside a DDM or FCFE model to assess the consistency of results. If the different models provide dramatically different estimates, the inconsistencies may result from the models' underlying assumptions.

LOS 23.j: Explain strengths and weaknesses of residual income models and justify the selection of a residual income model to value a company's common stock.

Strengths of residual income models include the following:

- Terminal value does *not* dominate the intrinsic value estimate, as is the case with dividend discount and free cash flow valuation models.
- Residual income models use accounting data, which is usually easy to find.
- The models are applicable to firms that do *not* pay dividends or that do not have positive expected free cash flows in the short run.

- The models are applicable even when cash flows are volatile.
- The models focus on economic profitability rather than just on accounting profitability.

Weaknesses of residual income models include the following:

- The models rely on accounting data that can be manipulated by management.
- Reliance on accounting data requires numerous and significant adjustments.
- The models assume that the clean surplus relation holds or that its failure to hold has been properly taken into account.

PROFESSOR'S NOTE

The clean surplus relation can be expressed as $B_t = B_{t-1} + E_t - D_t$, which means that ending book value of equity equals the beginning book value plus earnings less dividends, excluding ownership transactions. This is the relationship that we used in the preceding examples to forecast end-of-period book value. Any accounting charges that are taken directly to the equity accounts (such as currency translation gains and losses) will cause the clean surplus relation not to hold.

Residual income models are *appropriate* under the following circumstances:

- A firm does not pay dividends, or the stream of payments is too volatile to be sufficiently predictable.
- Expected free cash flows are negative for the foreseeable future.
- The terminal value forecast is highly uncertain, which makes dividend discount or free cash flow models less useful.

Residual income models are *not appropriate* under the following circumstances:

- The clean surplus accounting relation is violated significantly.
- There is significant uncertainty concerning the estimates of book value and return on equity.

LOS 23.k: Describe accounting issues in applying residual income models.

PROFESSOR'S NOTE

This section is really just a brief summary of all the financial statement analysis material in the Financial Statement Analysis topic area. As an analyst, your job is to take financial statements prepared according to GAAP, convert them to something that better reflects economic reality, and use these updated statements to estimate value. Here we discuss the typical adjustments necessary to implement residual income models, but most of these adjustments were also addressed in more detail in the financial statement analysis material.

Conceptually, the residual income model is very straightforward; we just forecast residual income using some easily available accounting numbers and estimate the value of the equity. Unfortunately, in practice it's not quite so simple because we have to make a lot of adjustments to reported net income to arrive at a true measure

of comprehensive income, which is an income measure that includes all the firm's valuation changes. Following is a discussion of some common accounting issues that come up when we try to apply residual income models.

Clean Surplus Violations

The clean surplus relationship (i.e., ending book value = beginning book value + net income – dividends) may not hold when items are charged directly to shareholders' equity and do not go through the income statement. Therefore, we have to adjust net income to account for these items if they are not expected to reverse in the future. Items that can bypass the income statement include:

- Foreign currency translation gains and losses that flow directly to retained earnings under the current rate method.
- Certain pension adjustments.
- Gains/losses on certain hedging instruments.
- Changes in revaluation surplus (IFRS only) for long-lived assets.
- Changes in the value of certain liabilities due to changes in the liability's credit risk (IFRS only).
- Changes in the market value of debt and equity securities classified as available-for-sale.

The effect of violations of the clean surplus relationship is that net income is not correct, but book value is still correct. The risk in applying the residual income model when the clean surplus relation doesn't hold is that the ROE forecast will not be accurate if the clean surplus violations are not expected to offset in future years. For example, suppose the analyst determines that the clean surplus relation is violated because of the cumulative translation adjustment (CTA) resulting from the application of the current rate method of currency translation. (See the reading on Multinational Operations if the current rate method doesn't sound familiar!) If the CTA tends to reverse over time and is not consistently positive or negative, the ROE can be forecasted without taking into account the CTA.

Variations from Fair Value

The accrual method of accounting causes many balance sheet items to be reported at book values that are significantly different than their market values. Common adjustments to the balance sheet necessary to reflect fair value include the following:

- *Operating leases* should be capitalized by increasing assets and liabilities by the present value of the expected future operating lease payments. Interest expense in the income statement should be close to the true cost of debt.
- *Special purpose entities* (SPEs) whose assets and liabilities are not reflected in the financial statements of the parent company should be consolidated.
- *Reserves and allowances* should be adjusted. For example, the allowance for bad debts, which is an offset to accounts receivable, should reflect the expected loss experience.
- *Inventory* for companies that use LIFO (last in, first out) should be adjusted to FIFO (first in, first out) by adding the LIFO reserve to inventory and equity,

assuming no deferred tax impact.

- The *pension asset or liability* should be adjusted to reflect the funded status of the plan, which is equal to the difference between the fair value of the plan assets and the projected benefit obligation (PBO).
- *Deferred tax liabilities* should be eliminated and reported as equity if the liability is not expected to reverse (e.g., if the deferred tax liability results from different depreciation methods for tax and financial statement reporting purposes, and if the company is growing).

Intangible Asset Effects on Book Value

Two intangible assets require special attention: (1) intangibles recognized at acquisition and (2) R&D expenditures.

Recognition of an identifiable intangible asset (such as a license) in the group accounts that was not previously recorded in the investee company balance sheet creates a distortion in valuation under a residual income model. The amortization of such intangible assets reduces the combined ROE, and hence results in lower valuation of the combined entity compared to the sum of the values of individual entities prior to acquisition. To remove this distortion, the amortization of intangibles capitalized during acquisition should be removed prior to computing the ROE used for residual income valuation.

The suggested analytical treatment of **R&D expenditures** is less definitive, but we can make the general statement that the ROE estimate for a mature company should reflect the long-term productivity of the company's R&D expenditures: Productive R&D expenditures increase ROE and residual income, and unproductive expenditures reduce ROE and residual income.

Nonrecurring Items and Other Aggressive Accounting Practices

Nonrecurring items should not be included in residual income forecasts because they represent items that are not expected to continue in the future. Items that may need adjustment in measuring recurring earnings include discontinued operations, accounting changes, unusual items, extraordinary items, and restructuring charges.

Firms may adopt other types of aggressive accounting practices that overstate the book value of assets and earnings by, for example, accelerating revenues to the current period or deferring expenses to a later period.

International Accounting Differences

Residual income models, which are based on accrual accounting information, may not be as useful in valuing foreign firms because of differences in national accounting standards. Some things to consider in applying residual income models in global valuation settings include the following:

- How reliable are earnings forecasts?
- Are there systematic violations of the clean surplus relation?

- Do poor quality accounting rules result in financial statements that bear no resemblance to the economic reality of the business?

MODULE QUIZ 23.5

1. Karuba Manufacturing has a book value of $15 per share and is expected to earn $3.00 per share indefinitely. The company does not reinvest any of its earnings. Karuba's beta is 0.75, the risk-free rate is 4%, and the expected market risk premium is 8%. The value of Karuba stock according to the dividend discount model and the residual income model are *closest* to:

	Dividend discount model	Residual income model
A.	$42.86	$15.00
B.	$42.86	$30.00
C.	$30.00	$30.00

2. Kim Dae-Eun, CFA, values Olympic Productions at $78 per share with a residual income model using historical data to estimate return on equity and book value as reported on the balance sheet. Subsequently, he determines that Olympic has, for the past five years, been improperly capitalizing and amortizing expenditures that it should have expensed as they were incurred. What will be the effect on his forecasts of return on equity (ROE), book value, and intrinsic value if he revises his valuation estimate to take these "financial shenanigans" into account?

	ROE	Book value	Intrinsic value
A.	No effect	No effect	No effect
B.	Decrease	No effect	Decrease
C.	Decrease	Decrease	Decrease

3. Kim Dae-Eun, CFA, values Zues Printing Company at $46 per share with a residual income model using historical data to estimate return on equity and book value as reported on the balance sheet. Subsequently, he determines that Zues uses the current rate method of foreign currency translation and has, for the past ten years, consistently reported foreign currency translation gains as part of comprehensive income. He expects these foreign currency gains will continue in the future. What will be the effect on his forecasts of return on equity (ROE), book value, and intrinsic value if he revises his valuation estimate to take this new information into account?

	ROE	Book value	Intrinsic value
A.	Increase	Increase	Increase
B.	Increase	No effect	Increase
C.	No effect	Increase	Increase

KEY CONCEPTS

LOS 23.a

Residual income is net income less a charge for common stockholders' opportunity cost of capital.

EVA and MVA are alternatives to residual income as measures of economic profit. These models are typically used in the measurement of managerial effectiveness and executive compensation. However, they are gaining acceptance as appropriate models for equity valuation.

EVA = NOPAT – (WACC × total capital) = [EBIT × (1 – t)] – $WACC

MVA = market value – total capital

LOS 23.b

Residual income and related models are used for equity valuation, tests for goodwill impairment, measurement of managerial effectiveness, and calculation of executive compensation.

LOS 23.c

Residual income is calculated from accounting data as:

$$RI_t = E_t - (r \times B_{t-1})$$

where:

E_t = expected EPS for year t
r = required return on equity
B_{t-1} = book value in year t − 1

The residual income model breaks the intrinsic value of a stock into two elements:

(1) current book value of equity and (2) present value of expected future residual income:

$$V_0 = B_0 + \left\{ \frac{RI_1}{(1+r)^1} + \frac{RI_2}{(1+r)^2} + \frac{RI_3}{(1+r)^3} \cdots \right\}$$

where:

B_0 = current book value
r = required return on equity

Valuation with residual income models is relatively less sensitive to terminal value estimates than dividend discount and free cash flow models. This is because intrinsic values estimated with residual income models include the firm's current book value, which usually represents a substantial percentage of the estimated intrinsic value.

LOS 23.d

The fundamental drivers of residual income are ROE in excess of the cost of equity and the earnings growth rate.

LOS 23.e

If ROE is equal to the required return on equity, the justified market value of a share of stock is equal to its book value. When ROE is higher than the required return on equity, the firm will have positive residual income and will be valued at more than book value. In that case, the P/B ratio will be greater than one.

LOS 23.f

The single-stage residual income model is:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g} \right]$$

LOS 23.g

The growth rate implied by the market price in a single-stage residual income model is:

$$g = r - \left[\frac{B_0 \times (ROE - r)}{V_0 - B_0} \right]$$

LOS 23.h

For multistage residual income models, first forecast residual income over a short-term horizon, and then make some simplifying assumptions about the pattern of residual income growth over the long term. Continuing residual income is the residual income that is expected over the long term. The present value of continuing residual income in year T − 1 is equal to:

$$\frac{RI_T}{(1 + r - \omega)}$$

- If residual income is expected to persist at the current level forever, $\omega = 1$.
- If residual income is expected to drop immediately to zero, $\omega = 0$.
- If residual income is expected to decline over time after year T as ROE falls to the cost of equity capital, then the persistence factor, ω, is between zero and one.

Another way to estimate continuing residual income without using the persistence factor is to assume residual income is expected to decline to a normal long-run level consistent with a mature industry. Then the premium over book value ($P_T - B_T$) is equal to the present value of continuing residual income in year T, and the present value of continuing residual income in year T − 1 is:

$$\frac{(P_T - B_T) + RI_T}{1 + r}$$

In the residual income model, intrinsic value is the sum of three components:

$V_0 = B_0$ + (PV of interim high-growth RI) + (PV of continuing residual income)

LOS 23.i

DDM and FCFE models estimate value as the discounted present value of expected future cash flows. The residual income model estimates value as book value plus the present value of the expected stream of annual residual income.

Residual income models may be used to assess the consistency of other valuation models.

LOS 23.j

The following are strengths of residual income models:

- Terminal value does not dominate the intrinsic estimate.
- Residual income models use accounting data, which is usually easy to find.
- The models are applicable to firms that do not pay dividends or that do not have positive expected free cash flows in the short run.
- The models are applicable even when cash flows are volatile.
- The models focus on economic rather than just on accounting profitability.

The following are weaknesses of the residual income models:

- The models rely on accounting data that can be manipulated by management.
- Reliance on accounting data requires numerous and significant adjustments.
- The models assume that the clean surplus relation holds or that its failure to hold has been properly taken into account.

Residual income models are appropriate under the following circumstances:

- A firm does not pay dividends, or the stream of payments is too volatile to be sufficiently predictable.
- Expected free cash flows are negative for the foreseeable future.
- The terminal value forecast is highly uncertain, which makes dividend discount or free cash flow models less useful.

Residual income models are not appropriate under the following circumstances:

- The clean surplus accounting relation is violated significantly.
- There is significant uncertainty concerning the forecast of book value and return on equity.

LOS 23.k

In applying the residual income valuation approach, analysts often must take into account the following:

- Violations of the clean surplus relationship.
- Balance sheet adjustments for fair value.
- Intangible assets.
- Nonrecurring items.
- Other aggressive accounting practices.
- International accounting differences.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 23.1, 23.2

1. **C** The stock's terminal value as of Year 5 is:

$$TV_5 = \frac{C\$11.25}{0.10} = C\$112.50$$

The present value of this Year 5 terminal value is:

$$PV = \frac{C\$112.50}{(1.10)^5} = C\$69.85$$

Thus, the justified value of SS is currently C$75.00 + C$69.85 = C$144.85. (Module 23.2, LOS 23.c)

Module Quiz 23.3

1. **C** Stock P has model price higher than the market price and hence is undervalued. Stock Q has model price lower than the market price and hence is overvalued. Stock R has model price equal to the market price and hence is fairly valued. (LOS 23.f)

2. **C** We know that: $V_0 = B_0 + \left(\frac{(ROE - r) \times B_0}{r - g}\right)$. Since the shares are fairly priced, V_0 = P = $25.00. It follows that:

$$B_0 = \frac{V_0}{P/B} = \frac{\$25.00}{5.00} = \$5.00$$

Substituting, we get:

$$\$25.00 = \$5.00 + \left(\frac{(0.18 - r) \times \$5.00}{r - 0.08}\right)$$

Dividing both sides by $5.00 and rearranging, we get:

$$4.00 = \left(\frac{0.18 - r}{r - 0.08}\right) \Rightarrow 4r - 0.32 = 0.18 - r$$

$$5r = 0.50 \Rightarrow r = 0.10 = 10\%$$

(LOS 23.f)

3. **C** Use the single-stage residual income model to solve for the justified P/B multiple, then solve for ROE given the other variables:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right] \Rightarrow \frac{V_0}{B_0} = 1 + \frac{ROE - r}{r - g}$$

$$2.14 = 1 + \frac{ROE - 0.12}{0.12 - 0.05} \Rightarrow ROE = 0.20 = 20\%$$

or alternatively:

$$\text{Justified P/B} = (ROE - g) / (r - g)$$

rearranging ...

$$ROE = [(\text{Justified P/B}) \times (r - g)] + g$$

$$ROE = [(2.14) \times (0.12 - 0.05)] + 0.05 = 0.20$$

(LOS 23.f)

4. **A** The single-stage residual income model is:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$

The second term in the equation is the present value of future expected residual income. Rocky's ROE is greater than its cost of equity capital, so that second term is positive. That means intrinsic value is greater than book value, and the justified price-to-book ratio is greater than one. (LOS 23.f)

5. **A** ROE is equal to forecasted earnings per share divided by current book value per share:

$$ROE = \frac{\$0.45}{\$4.50} = 0.10 = 10\%$$

The single-stage residual income model is:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$

The second term in the equation is the present value of future expected residual income. The ROE is equal to the cost of equity capital (both are 10%),

so the second term is zero. That means intrinsic value is equal to book value and the justified price-to-book ratio is equal to one. (LOS 23.f)

Module Quiz 23.4

1. **C** All three alternative assumptions will reduce continuing residual income below the level implied by the assumption that it remains constant forever. A falling ROE will reduce residual income over time because residual income decreases as the spread between ROE and the cost of equity decreases. Therefore, the value estimate will drop below $68 in all three cases. (LOS 23.h)

2. **B** BCB's required rate of return, *r*, can be computed using the capital asset pricing model (CAPM) as follows:

$$r = 4.5\% + (0.7 \times 5.0\%) = 8.0\%$$

The calculation of $RI = Earnings_t - r \times Book_{t-1}$ for the next three years is shown in the following table.

Expected RI Computations

	2024	2025	2026	2027
Beginning book value per share (B_{t-1})	£10.62	£11.89	£13.32	£14.91
Earnings per share forecast ($E_t = 0.2 \times B_{t-1}$)	2.12	2.38	2.66	
Dividends per share forecast ($D_t = 0.4 \times E_t$)	0.85	0.95	1.07	
Forecast book value per share ($B_{t-1} + E_t - D_t$)	11.89	13.32	14.91	
Equity charge per share ($B_{t-1} \times r$)	0.85	0.95	1.07	
Per share RI [$E_t - (B_{t-1} \times r)$]	£1.27	£1.43	£1.59	

The present value in 2023 of 2024 and 2025 residual income is:

$$PV(RI_{2024,\,2025}) = \frac{£1.27}{1.08} + \frac{£1.43}{1.08^2}$$
$$= 1.18 + 1.23$$
$$= £2.41$$

As indicated in the preceding table, the book value at the beginning of 2027 (end of 2026) is £14.91. The market price in 2026 for BCB is assumed to be four times B_{2026}, so:

$$P_{2026} = 4 \times 14.91 = £59.64$$

The present value of continuing residual income as of the end of 2025 is:

$$\frac{(P_{2026} - B_{2026}) + RI_{2026}}{1 + r} = \frac{(£59.64 - £14.91) + £1.59}{1.08} = £42.89$$

(LOS 23.h)

3. **B** The present value of residual income in 2023 is:

$$\frac{£42.89}{1.08^2} = £36.77$$

end of 2023 value per share of BCB stock

= current book value + sum of discounted RIs + PV of continuing residual income

= £10.62 + £2.41 + £36.77 = £49.80

(LOS 23.h)

4. **C**

$$B_0 = \frac{\text{book value of equity}}{\text{shares outstanding}} = \frac{€435{,}000{,}000}{60{,}000{,}000} = €7.25 \text{ per share}$$

Year	E_t	B_t	ROE*	Equity Charge ($r \times B_{t-1}$)	Residual Income $E_t - (r \times B_{t-1})$
0		€7.25			
1	€1.16	8.41	0.16	€0.87	€0.29
2	1.35	9.76	0.16	1.01	0.34
3	1.56	11.32	0.16	1.17	0.39
4	1.81	13.13	0.16	1.36	0.45

* Earnings per share (EPS) is equal to beginning book value multiplied by ROE.

In this case, ω = 0. The present value of continuing residual income in Year 3 =

$$\frac{RI_4}{1+r-\omega} = \frac{0.45}{1+0.12-0} = \frac{0.45}{1.12} = \$0.40.$$

$$V_0 = €7.25 + \left[\frac{€0.29}{1.12} + \frac{€0.34}{1.12^2} + \frac{€0.39 + €0.40}{1.12^3}\right] = €8.34$$

Since the shares are valued at €8.34 each and the current market price per share is €8.75, the shares are overpriced, and the analyst should consider issuing a sell recommendation. (LOS 23.c)

5. **B** We now modify the information in the last problem and assume that residual income remains constant at €0.45 after the initial forecast period, so ω = 1. Continuing residual income in Year 3 is $\frac{0.45}{1+0.12-1}$

$$= \frac{0.45}{0.12} = €3.75.$$

$$V_0 = €7.25 + \left[\frac{€0.29}{1.12} + \frac{€0.34}{1.12^2} + \frac{€0.39 + €3.75}{1.12^3}\right] = €10.73$$

In this case, the value of the shares exceeds the current price of €8.75 and the analyst should consider issuing a buy recommendation. (LOS 23.c)

6. **C** Residual income begins to decline after Year 4, (ω = 0.3) so the present value of continuing residual income in Year 3 is:

present value of continuing residual income in Year 3

$$= \frac{€0.45}{1+0.12-0.3} = €0.55$$

The intrinsic value today is book value plus the present value of Years 1 through 3 residual income plus the present value of continuing residual income:

$$V_0 = €7.25 + \left[\frac{€0.29}{1.12} + \frac{€0.34}{1.12^2} + \frac{€0.39 + €0.55}{1.12^3}\right] = €8.45$$

Since the shares are valued at €8.45 and the current market price is €8.75, the shares are overpriced and the analyst should consider issuing a sell recommendation. (LOS 23.c)

Module Quiz 23.5

1. **C** Dividend discount model:

$$r = 4\% + (0.75 \times 8\%) = 10\%$$

$$\text{dividend} = \text{earnings} = \$3.00$$

$$\text{value} = \frac{\$3.00}{0.10} = \$30.00$$

Residual income model:

$$\text{residual income} = \$3.00 - (0.10 \times \$15) = \$1.50$$

$$\text{value} = \$15.00 + \frac{\$1.50}{0.10} = \$30.00$$

(LOS 23.i)

2. **C** Improperly capitalizing expenditures that should have been expensed will cause return on equity and book value forecasts to be overstated. Correcting the valuation to reflect the overstatement of both of these forecasts would cause the ROE estimate to decrease, the book value per share to decrease, and the intrinsic value from the residual income model to decrease. (LOS 23.k)

3. **B** The foreign currency translation gains were recorded directly to equity as part of comprehensive income and were not reflected in income, so his ROE forecast was understated. If he expects these gains to continue, he should revise his forecast upward of ROE. Book value was not affected, however, because the gains were recorded to equity. Correcting the valuation to reflect these changes would cause his ROE estimate to increase, the book value per share to stay the same, and the intrinsic value from the residual income model to increase. (LOS 23.k)

READING 24

PRIVATE COMPANY VALUATION

EXAM FOCUS

For the exam, be familiar with differences between private and public companies and know the different definitions and approaches for value estimation. Be prepared to normalize earnings, determine an appropriate discount rate, and calculate private firm value. Know when and how discounts for control and marketability are applied.

MODULE 24.1: PRIVATE COMPANY BASICS

Video covering this content is available online.

LOS 24.a: Contrast important public and private company features for valuation purposes.

Private firms encompass sole proprietorships, privately held corporations, and previously public companies that have been taken private. The characteristics that distinguish private and public companies can be delineated into company-specific and stock-specific factors.

Company-Specific Factors

Company-specific factors include the following:

- *Stage of life cycle*. Private companies are typically less mature than public firms. Sometimes, however, private firms are mature firms or bankrupt firms near liquidation. The valuation analysis will vary with the life cycle stage of the firm.
- *Size*. Private firms typically have less capital, fewer assets, and fewer employees than public firms—as such, they can be riskier. Accordingly, private firms are often valued using greater risk premiums and greater required returns compared to public firms. A lack of access to public equity markets can constrain a private firm's growth. However, the regulatory burden associated with issuing public equity may outweigh the benefits of greater access to funds.
- *Quality and depth of management*. Smaller private firms may not be able to attract as many qualified applicants as public firms. This may reduce the depth of management, slow growth, and increase risk at private firms.
- *Management/shareholder overlap*. In most private firms, management has a substantial ownership position, reducing principal-agent conflict. This gives external shareholders little influence, and it helps the firm to take a longer-term perspective.

- *Short-term investors*. Although manager compensation in public firms often includes incentive compensation such as stock options, shareholders often focus on short-term measures of performance, such as the level and consistency of quarterly earnings. In such cases, management may take a shorter-term view compared to private firms where managers are long-term holders of significant equity interests.
- *Quality of financial and other information*. Public firms are required to make timely, in-depth financial disclosures. A potential creditor or equity investor in a private firm will have less information than is available for a public firm. This leads to greater uncertainty, higher risk, and it reduces private firm valuations. Note that in the case of fairness opinions for private firm valuations, the analyst typically has complete access to the firm's financial statements and business records.
- *Taxes*. Private firms may be more concerned with taxes than public firms due to the impact of taxes on private equity owners/managers.

Stock-Specific Factors

The stock-specific differences between private and public firms often include the following:

- *Liquidity*. Private company equity typically has fewer potential owners and is less liquid than publicly traded equity. Thus, a liquidity discount is often applied in valuing privately held shares.
- *Restrictions on marketability*. Private companies often have agreements that prevent shareholders from selling, reducing the marketability of shares.
- *Concentration of control*. The control of private firms is usually concentrated in the hands of a few shareholders, which may lead to greater perks and other benefits to owners/managers at the expense of minority shareholders.

Overall, company-specific factors can have positive or negative effects on private company valuations, whereas stock-specific factors are usually a negative. Compared to public companies, private companies have greater heterogeneity, so that the appropriate discount rates and methods for valuing them vary widely as well.

LOS 24.b: Describe uses of private business valuation and explain key areas of focus for financial analysts.

There are three reasons for valuing the total capital and/or equity capital of private companies: transactions, compliance, and litigation.

Transaction-Related Valuations

Transaction-related valuations are necessary when selling or financing a firm:

- *Venture capital financing*. Firms in the development stage often need external financing for capital investment and receive private financing from venture capital investors. To reduce risk to the venture capital investor, the capital is often provided in rounds after the achievement of specific benchmarks known as

milestones. Valuations are usually subject to negotiation and are somewhat informal due to the uncertainty of future cash flows.

- *Initial public offering (IPO)*. A public sale of the firm's equity increases its liquidity. Investment banks often perform IPO valuations using the values of similar public firms as a benchmark.
- *Sale in an acquisition*. Development-stage or mature private firms are often sold to generate liquidity for the owners. Valuations are usually performed by both the firm and the buyer and are subject to negotiation.
- *Bankruptcy proceedings*. For firms in bankruptcy, accurate valuation can help determine whether the firm should be liquidated or reorganized. If it is determined that the firm can continue as a going concern, accurate valuation is important in its restructuring.
- *Performance-based managerial compensation*. If a firm compensates employees with stock options, grants of restricted stock, or employee stock ownership plans, accurate valuation is necessary for both accounting and tax purposes.
- *Debt financing*. Lenders may be interested in valuation as part of their underwriting process.

Compliance-Related Valuations

Compliance-related valuations are performed for legal or regulatory reasons. They primarily focus on financial reporting and tax issues:

- *Financial reporting*. Valuations in this area are often related to goodwill impairment tests in which units of a public firm are valued using private company valuation methods. The reporting of stock-based compensation also requires accurate valuation.
- *Tax purposes*. At the firm level, transfer pricing, property taxes, and corporate restructuring may necessitate valuations. For individual equity owners, estate and gift tax issues may necessitate valuations.

Litigation-Related Valuations

Litigation-related valuations may be required for shareholder suits, damage claims, lost profits insurance claims, or divorce settlements.

Because the valuation methods for transactions, compliance, and litigation are often quite different, most appraisers specialize in a single area. Transaction-related valuations are usually performed by investment bankers, compliance-related valuations by those with accounting or tax knowledge, and litigation-related valuations by those comfortable with a legal setting and specific jurisdictions.

LOS 24.c: Explain cash flow estimation issues related to private companies and adjustments required to estimate normalized earnings.

In valuing a firm, the appropriate earnings definition is **normalized earnings**: "firm earnings *if* the firm were acquired." The adjustments required to arrive at normalized earnings are discussed as follows.

PROFESSOR'S NOTE

In a previous topic review, we calculated normalized earnings as the average earnings over the business cycle. Here, the calculation of normalized earnings requires adjustment for firm-specific characteristics. Normalized earnings, in this case, is similar to the concept of underlying earnings discussed previously—but with adjustments unique to private companies.

Estimating Normalized Earnings

Normalized earnings should exclude nonrecurring and unusual items. In the case of private firms with a concentrated control, there may be discretionary or tax-motivated expenses that need to be adjusted when calculating normalized earnings. These adjustments can be quite significant when the firm is small.

When a closely controlled firm does business with its owners or other businesses controlled by its owners, firm expenses may be inflated—and reported earnings, therefore, may be artificially low. Artificially low earnings may also be the result of excessively high owner compensation, or of personal expenses charged to the firm. These expenses will also affect the firm's tax expense. The adjustments are potentially larger when the owners' family members have connections to the firm. Use of company-owned assets (e.g., aircraft, personal residences, company-provided life insurance, loans for managers/owners) potentially require an adjustment to earnings.

On the other hand, if a firm is performing poorly, the owners may be receiving compensation below market levels. In this case, reported earnings would overstate normalized earnings.

Any real estate owned by the firm may merit treatment separate from that of firm operations. For example, real estate is likely to have different risk characteristics than the firm's operations. Further, the properties' depreciation expense is based on historical cost and does not reflect the current rental cost. Some analysts will remove any income and expenses from real estate on the income statement. If it is used in the firm's business, a market-estimated rental expense is used in calculating or estimating earnings. The value of real estate is, therefore, separated from its operations and treated as a nonoperating asset. If the real estate is leased from a related party, the lease rate should be adjusted to a market rate.

Other adjustments are common to both private and public companies (e.g., adjustments for differences in depreciation and inventory methods). Additionally, some private firm financial statements are *reviewed* rather than audited; some may be only compiled (i.e., no auditor opinion is provided). In any case, the analyst should be prepared to make further adjustments.

EXAMPLE: Normalized earnings

Tim Groh is the principal shareholder, CEO, and founder of Arbutus Generators (Arbutus). Arbutus reports the three following annual figures:

a. Groh's compensation of $2.5 million is included in the firm's selling, general, and administrative (SG&A) expenses.

b. Arbutus leases a warehouse for $100,000 a year from one of its largest suppliers.

c. Arbutus owns a vacant office building with reported SG&A expenses of $150,000 and $25,000 of depreciation expense.

An analyst determines that a market-based compensation for Groh's position is $1 million annually and that the office building is not needed for core operations. The market lease rate of the warehouse is $130,000 per year.

Based on the three annual figures just listed, what adjustments should the analyst make to Arbutus's reported income to estimate normalized earnings (earnings), assuming the firm will be acquired?

Answer:

a. Because the market rate is $1.5 million less than Groh's actual compensation, SG&A expenses should be reduced by $1.5 million to reflect a normalized compensation expense.

b. Because the market lease rate is $30,000 higher than the reported lease expense, SG&A expenses should be increased by $30,000 to reflect a normalized lease rate.

c. Because the office building is noncore, SG&A expenses should be reduced by $150,000, and the depreciation expense should be reduced by $25,000.

Estimating Cash Flow

Calculating free cash flow to the firm (FCFF) or to equity holders for private firms can be particularly challenging, given uncertain future cash flows and figures that are often generated using the current owners' input.

As noted previously, the valuation of equity depends on the definition of value used. Also, controlling and noncontrolling equity interests will have quite different values. These differences should be accounted for in cash flow estimates and assumptions.

When there is significant uncertainty about a private company's future operations, the analyst should examine several scenarios when estimating future cash flows. For development-stage firms, scenarios could include a sale of the firm, an IPO, bankruptcy, or continued private operation. For a mature firm, scenarios might include different ranges of cash flows based on different assumed growth rates.

For each scenario, the analyst must assign a discount rate and probability based on the scenario's risk and probability of occurring. A firm value for each scenario is estimated, and a weighted average of these values is used to estimate firm value. Alternatively, a weighted average scenario cash flow may be discounted using a single discount rate to arrive at an estimate of firm value.

Cash flow estimates often are based on current management estimates or result from analyst consultation with management. The analyst should be aware of the potential bias in management estimates. For example, management may overstate the value of goodwill or understate future capital needs.

Although analysts use FCFF or free cash flow to equity (FCFE) depending on the purposes of the valuation, FCFF is usually more appropriate when the significant changes in the firm's capital structure are anticipated. The reasoning is that the discount rate used for FCFF valuation, the weighted average cost of capital (WACC),

is less sensitive to leverage changes than the cost of equity, the discount rate used for FCFE valuation. Thus, the FCFF valuation is less sensitive to the degree of financial leverage assumed in the analysis than the FCFE valuation.

PROFESSOR'S NOTE

The calculations and adjustments here are similar to those in our previous coverage of the estimation of FCFF in that they start at operating income before interest expense. Noncash charges (NCC) are stated as depreciation and amortization here, and fixed capital investment is stated as capital expenditures.

EXAMPLE: Estimation of FCFF

An analyst has normalized the earnings and expenses for a private firm under consideration as an acquisition. Because the capital structure is nonoptimal, the analyst assumes that the capital structure will be changed if the firm is acquired and will use the FCFF approach to value the firm.

The following assumptions are used to create a pro forma income statement and to estimate FCFF.

Current revenues	$20,000,000
Revenue growth	4%
Gross profit margin	30%
Depreciation expense as a percentage of sales	2%
Working capital as a percentage of sales	10%
SG&A expenses	$2,200,000
Tax rate	30%

Additionally, capital expenditures will cover depreciation plus 6% of the firm's incremental revenues.

Create a pro forma income statement and estimate FCFF.

Answer:

Pro Forma Income Statement	
Revenues	$20,800,000
Cost of goods sold	$14,560,000
Gross profit	$6,240,000
SG&A expenses	$2,200,000
Pro forma EBITDA	$4,040,000
Depreciation and amortization	$416,000
Pro forma EBIT	$3,624,000
Pro forma taxes on EBIT	$1,087,200
Operating income after tax	$2,536,800
Adjustments to obtain FCFF	
Plus: depreciation and amortization	$416,000
Minus: capital expenditures	$464,000
Minus: increase in working capital	$80,000
FCFF	$2,408,800

The following provides an explanation for the previous calculations.

Pro Forma Income Statement	Explanation
Revenues	Current revenues times the growth rate: \$20,000,000 × 1.04
Cost of goods sold	Revenues times one minus the gross profit margin: \$20,800,000 × (1 − 0.30)
Gross profit	Revenues times the gross profit margin: \$20,800,000 × 0.30
SG&A expenses	Given in the question
Pro forma EBITDA	Gross profit minus SG&A expenses: \$6,240,000 − \$2,200,000
Depreciation and amortization	Revenues times the given depreciation expense: \$20,800,000 × 0.02
Pro forma EBIT	EBITDA minus depreciation and amortization: \$4,040,000 − \$416,000
Pro forma taxes on EBIT	EBIT times tax rate: \$3,624,000 × 0.30
Operating income after tax	EBIT minus taxes: \$3,624,000 − \$1,087,200
Adjustments to obtain FCFF	*Explanation*
Plus: depreciation and amortization	Add back noncash charges from those listed previously
Minus: capital expenditures	Expenditures cover depreciation and increase with revenues: \$416,000 + [0.06 × (\$20,800,000 − \$20,000,000)]
Minus: increase in working capital	Working capital will increase as revenues increase: 0.10 × (\$20,800,000 − \$20,000,000)
FCFF	Operating income net of the adjustments listed previously

MODULE QUIZ 24.1

1. Compared to public firms, private firms are *most likely* to have:
   A. fewer tax concerns.
   B. a longer-term focus.
   C. less managerial ownership.

2. Which of the following *most accurately* describes the process of valuation in venture capital financing?
   A. Valuations are usually based on negotiation.
   B. Discounted cash flow and price multiple analysis are typically used.
   C. The appraiser estimates value using comparable company values and the prices of recent IPOs.

3. Suppose that we are provided the following figures for a private firm that is an acquisition target:

Reported EBITDA	$6,700,000
Current executive compensation	$800,000
Market-based executive compensation	$650,000
Current lease rate	$200,000
Market-based lease rate	$250,000

Normalized EBITDA is *closest* to:

A. $6,800,000.
B. $6,900,000.
C. $7,000,000.

4. Suppose that we are provided the following figures for a medical diagnostic and consumer health care technology. (Assume that the earnings and expenses are normalized, and that capital expenditures will equal depreciation plus 4% of the firm's incremental revenues.)

Current revenues	$10,000,000
Revenue growth	5%
Gross profit margin	20%
Depreciation expense as a percentage of sales	1%
Working capital as a percentage of sales	12%
SG&A expenses	$1,600,000
Tax rate	40%

Based on a pro forma income statement, forecasted FCFF for the next year is *closest* to:

A. $157,000.
B. $277,000.
C. $407,000.

MODULE 24.2: DISCOUNT RATE

Video covering this content is available online.

LOS 24.d: Explain factors that require adjustment when estimating the discount rate for private companies.

Estimating the discount rate in a private firm valuation can be quite challenging for the following reasons:

- *Size premiums.* Size premiums are often added to the discount rates used for small private companies. Estimates of this premium based on small public firm data may be biased upward if some of the small firms in the sample were formerly larger companies that are now experiencing financial distress.
- *Availability and cost of debt.* A private firm may have less access to debt financing than would a public firm. Because equity capital is usually more expensive than debt, and because the higher operating risk of smaller private companies also results in a higher cost of debt, WACC will typically be higher for private firms.
- *Acquirer versus target.* When acquiring a private firm, some acquirers will incorrectly use their own (lower) cost of capital, rather than the higher rate appropriate for the target. Thus, they will arrive at a value for the target company

that is too high. The target should be valued using its own cost of capital to reflect risk differences between the target and the acquirer.

- *Projection risk*. The lower availability of information about private firms may make it appropriate for an analyst to apply a higher discount rate. Additionally, the private firm's management may be inexperienced at forecasting, making the upward or downward adjustment of earnings forecasts appropriate. (However, such adjustments are highly subjective.)
- *Life cycle stage*. It is particularly difficult to estimate the discount rate for a firm in an early stage of development. If such firms have unusually high levels of unsystematic risk, the use of the capital asset pricing model (CAPM) may be inappropriate. Although ranges of discount rates can be specified for the various life cycle stages, it may be difficult to accurately classify the stage a firm is in.

LOS 24.e: Compare models used to estimate the required rate of return to private company equity (for example, the CAPM, the expanded CAPM, and the build-up approach).

Using the CAPM, the expanded CAPM, and build-up methods to estimate discount rates for private firms may not be as straightforward as it is for public firms.

With *CAPM*, beta is traditionally estimated from public firm data. However, such a beta estimate may not be appropriate for private firms that have little chance of going public or being acquired by a public firm. Due to the differences between large public firms and small private firms, some U.S. tax courts have rejected the use of the CAPM for private firms.

While using comparable beta as a proxy for the subject company, an adjustment should be made for leverage differences.

First, we unlever the comparable public company beta using its tax rate and debt-to-equity ratio:

$$\beta_{\text{unlevered}} = \frac{\beta_{\text{public}}}{\left[1 + (1 - t)\left(\frac{D}{E}\right)\right]}$$

Then, to arrive at the estimate of private company beta, we adjust this unlevered beta using the subject private company's tax rate (t*) and leverage (D/E)*:

$$\beta_{\text{private company}} = \beta_{\text{unlevered}}\left[1 + (1 - t^*)\left(\frac{D}{E}\right)^*\right]$$

Beta is a measure of systematic risk, which makes it appropriate in a well-diversified portfolio context. However, investments in private companies may be large, unique, and undiversified. Thus, additional risk premiums may be applicable.

The *expanded CAPM* version includes additional premiums for size and firm-specific (unsystematic) risk.

The *build-up method* can be used when it is not possible to find comparable public firms for beta estimation. Beginning with the expected return on the market (i.e.,

beta is implicitly assumed to be one), premiums are added for small size, industry factors, and company-specific factors.

EXAMPLE: Private company required rate of return

An analyst is examining a private firm being considered for acquisition and determines the following:

- The current capital structure is nonoptimal because the owner avoids using debt.
- A small stock premium and company-specific risk premium are appropriate because the private firm is much smaller and much less diversified than the public firms that beta is estimated from.
- An industry risk premium is needed to account for the additional risk in this industry compared to the broad market.

The relevant figures are as follows.

Risk-free rate	3.6%
Equity risk premium	6.0%
Beta	1.3
Small stock premium	3.0%
Company-specific risk premium	2.0%
Industry risk premium	1.0%
Pretax cost of debt	9.0%
Debt/total cap for public firms in industry	30%
Optimal debt/total cap	12%
Current debt/total cap	3%
Tax rate	30%

Questions:

a. Calculate the required return on equity using the CAPM, the expanded CAPM, and the build-up method.

b. Calculate the WACC using the current capital structure and the optimal capital structure, assuming a cost of equity of 16%.

c. Comment on the appropriate capital structure weights.

Answer:

a. The required return on equity using the CAPM is as follows: required return = $Rf + (\beta \times ERP) = 3.6\% + 1.3(6\%) = 11.4\%$.

Using the expanded CAPM, a small stock premium and company-specific risk premium are added: $11.4\% + 3\% + 2\% = 16.4\%$.

Using the build-up method, beta is omitted (but an industry risk premium is added): $3.6\% + 6\% + 1\% + 3\% + 2\% = 15.6\%$.

b. The WACC, using current capital structure, is as follows:

$WACC = (w_e \times r_e) + [w_d \times r_d \times (1 - \text{tax rate})]$

$= (0.97 \times 16\%) + [0.03 \times 9\% \times (1 - 30\%)]$

= 15.7%

The WACC, using the optimal capital structure, is as follows:

= (0.88 × 16%) + [0.12 × 9% × (1 – 30%)]

= 14.8%

c. The current capital structure reflects the current owner's conservative use of debt. The optimal capital structure can be determined through discussions with financiers. The optimal capital structure should be used to calculate the (lower) WACC for the acquisition, reflecting the higher level of debt the firm can support. The capital structure for public firms in the same industry should not be used because public firms are likely to have better access to debt financing. A public firm could likely take on more (less expensive compared to equity) debt than a private company. For this reason, a private firm will likely have a greater WACC than a public firm in the same industry.

LOS 24.f: Explain and evaluate the effects on private company valuations of discounts and premiums based on control and marketability.

Strategic and Nonstrategic Buyers

A transaction may be either strategic or financial. In a strategic transaction, valuation of the firm is based in part on the perceived synergies with the acquirer's other assets. Conversely, a financial transaction assumes no synergies, such as when one firm buys another in a dissimilar industry.

When estimating normalized earnings for a strategic transaction, the analyst should incorporate synergies as an increase in revenues, or as a reduction in costs.

EXAMPLE: Incorporating synergies

An analyst is valuing a firm with two different potential buyers. Buyer A is a firm in the same industry as the target firm, which expects to reduce costs at the target firm by eliminating redundancies. Buyer B is a firm in an unrelated industry.

Calculate the normalized EBITDA for each buyer given the following information.

Reported EBITDA	$4,800,000
Current executive compensation	$900,000
Market-based executive compensation	$600,000
Current SG&A expenses	$8,000,000
SG&A expenses after synergistic savings	$7,600,000

Answer:

Both the strategic (Buyer A) and nonstrategic (Buyer B) buyers will attempt to reduce executive compensation to market levels. So, the adjustment for both buyers to generate normalized EBITDA is $4,800,000 + ($900,000 – $600,000) = $5,100,000.

Only Buyer A will be able to realize synergistic savings of ($8,000,000 – $7,600,000) = $400,000. So, normalized EBITDA for Buyer A is $5,500,000; for

> Buyer B, it is $5,100,000.

In general, adjustments are required when the marketability or level of control of a potential acquisition differs from that of the comparable companies. For example, if the comparable firm values are for the purchase of an entire public company but we wish to value a minority stake in a private firm, we would need to apply discounts for both a lack of control and a lack of marketability.

Discount for Lack of Control

Regarding a discount for lack of control (DLOC), minority shareholders are at a disadvantage because they have less power to select the directors and management than do the controlling shareholders. Without a voice, minority shareholders cannot determine the investment policies and payout policies that affect the value of the firm and the distribution of earnings.

Controlling shareholders may enjoy excessive compensation and other perks to the detriment of minority shareholders. However, firms that will experience an IPO or sale are less likely to pursue actions that damage minority shareholders.

Because estimates of lack of control discount are not easily available, we back this information out of control premiums observed in public company takeover transactions:

$$\text{DLOC} = 1 - \left[\frac{1}{1 + \text{control premium}}\right]$$

For example, if the control premium is 25%:

$$\text{DLOC} = 1 - \left[\frac{1}{1 + 0.25}\right] = 20\%$$

Valuations based on discounted cash flow methods such as free cash flow (FCF) and the capitalized cash flow method (CCM) could also require adjustments, depending on whether the estimated and subject cash flows were on a controlling or noncontrolling interest basis.

Discount for Lack of Marketability

If an interest in a firm cannot be easily sold, a discount for lack of marketability (DLOM) should be applied. (A DLOM is sometimes also called a discount for lack of liquidity.) It is often the case that if a DLOC is applied, a DLOM will also be appropriate. For example, if a controlling shareholder believes that a private firm should not be sold, minority shareholders lack both the control and the ability to sell their position.

The DLOM may be impacted by numerous factors:

- An impending IPO or firm sale will decrease the DLOM.
- Contractual restrictions on selling stock will increase the DLOM.
- A larger pool of buyers will decrease the DLOM.
- Greater ownership concentration will increase the DLOM.

To estimate the DLOM, an analyst can use one of three methods:

1. In the first method, the price of the restricted shares is compared to the price of the publicly traded shares. (SEC Rule 144, for example, may restrict the sale of shares acquired in a firm before its IPO.)
2. In the second method, the price of pre-IPO shares is compared to that of post-IPO shares. However, one complicating factor is that post-IPO firms are generally thought to have more certain cash flows and lower risk, so the estimated DLOM may not purely reflect changes in marketability.
3. A third method estimates the DLOM as the value of an at-the-money put option of a comparable public company, divided by its stock price. The time to maturity of the option should correspond to the time to the IPO, and the volatility is based on the historical volatility of publicly traded stock, or the implied volatility of publicly traded options. An advantage of this option valuation approach over the other two DLOM estimation methods is that the estimated risk of the private company can be factored into the option price. The drawback of this approach is that a put option indicates a certain selling price—not actual liquidity.

Although these methods provide a basis for calculating the DLOM, it can be challenging to implement them. The data may be limited, and the interpretation of the data will vary; thus, the magnitude of the DLOM applied to a company will vary by analyst.

Because they are applied sequentially, the DLOC and DLOM are multiplicative, not additive. So, if the DLOC is 20%, and the DLOM is 13%, the total discount is NOT calculated as 20% + 13% = 33%, but as follows:

$$\text{total discount} = 1 - [(1 - \text{DLOC})(1 - \text{DLOM})]$$
$$= 1 - [(1 - 0.20)(1 - 0.13)] = 30.4\%$$

EXAMPLE: Calculating the value of a minority interest

A minority shareholder holds 15% of a private firm's equity, and the CEO holds the other 85%. Suppose that there are two possible scenarios.

In Scenario 1, the CEO is likely to sell the firm soon. In this case, the valuation discounts will be small. A DLOM of 5% will be applied. A DLOC will not be applied, under the assumption that all selling shareholders will receive the same price. The value of the firm's equity is estimated at $10 million.

In Scenario 2, the CEO has no plans to sell the firm, and the minority shareholder cannot sell their interest easily. A DLOM of 20% will be applied. A DLOC will be estimated by using reported earnings instead of normalized earnings to provide an estimated firm equity value of $9 million. The $9 million value assumes that certain firm inefficiencies (e.g., above-market compensation for the owner) cannot be corrected without a sale of the firm.

Given these figures, calculate the value of the minority shareholder's equity interest under both scenarios.

Answer:

The following provides the calculations under each scenario.

Scenario 1: Assuming sale is likely

Firm's equity value	$10,000,000
Minority interest	15%
Value of minority interest without discounts	$1,500,000
minus DLOC of 0%	0
Value of interest if marketable	$1,500,000
minus DLOM of 5%	$75,000
Value of minority interest	$1,425,000

Scenario 2: Assuming sale is unlikely

Firm's equity value	$9,000,000
Minority interest	15%
Value of minority interest without discounts	$1,350,000
minus DLOC of 0%	0
Value of interest if marketable	$1,350,000
minus DLOM of 20%	$270,000
Value of minority interest	$1,080,000

The smaller value of the minority interest in Scenario 2 is due to the higher DLOM and the DLOC (as reflected in the lower firm equity value of $9 million).

In addition to discounts for lack of control and marketability, other discounts—such as key person discount, portfolio concentration discount, and lack of voting rights discount—may also apply for a specific valuation.

MODULE QUIZ 24.2

1. The *most appropriate* WACC to apply to a private company being acquired is:
   A. the target's WACC.
   B. the acquirer's WACC.
   C. a weighted average of the target's and acquirer's WACC that factors in financing arrangements.
2. Which of the following models is *most appropriate* for estimating the discount rate for a private company when there are no comparable public equity firms?
   A. The CAPM.
   B. The build-up method.
   C. The expanded CAPM.

Use the following information to answer Questions 3 and 4.

Income return on bonds	5.7%
Capital return on bonds	1.1%
Long-term Treasury yield	4.8%
Beta	1.5
Equity risk premium	5.5%
Small stock premium	3.8%
Company-specific risk premium	2.5%
Industry risk premium	2.0%
Pretax cost of debt	10.0%
Optimal debt/total capital	15.0%
Current debt/total capital	4.0%
Debt/total capital for public firms in industry	40.0%
Tax rate	35.0%

3. The appropriate cost of equity for a mature private firm of similar size and firm-specific risk as its public comparable is *closest* to:
   A. 13.1%.
   B. 15.1%.
   C. 19.4%.

4. Suppose that we are considering the acquisition of a small private firm with a high degree of firm-specific risk, where the firm is dissimilar to public firms. The appropriate WACC to use is *closest* to:
   A. 12.1%.
   B. 14.5%.
   C. 16.8%.

5. All else equal, a larger DLOM is *most likely* to be associated with:
   A. an imminent IPO.
   B. lower asset risk.
   C. a smaller pool of buyers.

6. An analyst has been tasked with valuing a minority interest in a private company. Upon examining numerous comparable firms that have been acquired, she determines that a control premium of 18% is present in the acquisition prices. Further, the analyst determines that a discount for lack of marketability (DLOM) of 22% is appropriate for the private company interest. The total adjustment the analyst should make to the value of the comparables when valuing the private company interest is *closest* to:
   A. 33.9%.
   B. 36.0%.
   C. 40.6%.

MODULE 24.3: VALUATION

Video covering this content is available online.

LOS 24.g: Explain the income, market, and asset-based approaches to private company valuation and factors relevant to the selection of each approach.

The three major approaches to private company valuation are the income approach, the market approach, and the asset-based approach:

1. **Income approach.** This values a firm as the present value of its expected future income. Such valuation may be based on various different assumptions and variations.
2. **Market approach.** This values a firm using multiples from recent sales of comparable assets.
3. **Asset-based approach.** This values a firm as the value of its assets minus its liabilities.

PROFESSOR'S NOTE
These methods are similar to those used to value public companies, but they have different names. In the public equity world, the income approach is known as *discounted cash flow* or *present value analysis*.

The income approach and the asset-based approach are termed *absolute valuation models*. By contrast, with the market approach, value is determined relative to recent valuations of other assets.

In selecting an appropriate valuation approach, an analyst should consider the firm's life cycle stage. Early in its life, a firm's future cash flows may be subject to so much uncertainty that an asset-based approach would be most appropriate. As the firm moves to a high growth phase, it might be most appropriately valued using an income approach—in particular, a form of the income approach known as a *free cash flow (FCF) valuation model*. A mature firm might be most appropriately valued using the market approach.

Firm size is also a consideration in choosing a valuation methodology. Price multiples from large public firms should not be used to value a small private firm without some assurance that the risk and the growth prospects of the firms are similar.

A firm's assets typically consist of both operating and nonoperating assets. Nonoperating assets—those not crucial to the firm's primary operations and focus—are typified by excess cash and investment accounts. A valuation based on income or earnings multiples would not attach a value to these nonoperating assets. If these assets represent a significant portion of firm value, they should be separately added when valuing a firm.

Income Approaches

LOS 24.h: Calculate the value of a private company using income-based methods.

The income approach refers to valuation methods based on the idea that the value of an asset is the present value of its future income. Three methods consistent with the income approach are (1) the FCF method (a.k.a. the discounted cash flow method), (2) the capitalized cash flow method, and (3) the residual income (or excess earnings) method.

The Free Cash Flow Method

Under this method of private company valuation, a series of discrete cash flows are forecast, plus a terminal value that reflects the value of the business as a going concern at some future date. The terminal year represents the point of time in the future at which growth is expected to level off and remain constant. In practice, most analysts estimate the terminal value five years out. Once free cash flows have been estimated, they are discounted at a rate appropriate to their risk.

The terminal value can be calculated using a constant growth model (e.g., the dividend discount model). Some analysts use a price multiple approach to estimate a firm's terminal value. Note, however, that if the price multiple is for a firm in a high growth industry, the price multiple applied will often reflect both high growth and normal growth. In this case, the high growth is double counted—once in the price multiple and once in the periodic cash flow forecasts.

Terminal value can also be calculated using the capitalized cash flow method (discussed next).

PROFESSOR'S NOTE

The FCF method here is a two-stage model. The capitalized cash flow method described next is a single-stage model.

The Capitalized Cash Flow Method

This method is also known as the capitalized income method and the capitalization of earnings method. Under this method, a single measure of economic benefit is divided by a capitalization rate—equal to the required rate of return minus a growth rate—to arrive at firm value. This is a growing perpetuity model that assumes stable growth and is, in effect, a single-stage FCF model. The capitalized cash flow method is most often used for small private companies. It may be suitable when no comparables are available, projections are uncertain, and stable growth is a reasonable assumption. If growth is nonconstant, the FCF method should be used instead.

Valuing the firm as a whole using the CCM is as follows:

$$\text{value of the firm} = \frac{\text{FCFF}_1}{\text{WACC} - \text{g}}$$

where:

FCFF_1 = expected free cash flow to the firm over the next year

WACC = weighted average cost of capital (assuming a constant capital structure)

g = sustainable growth rate in free cash flows

This CCM formula could also be used in reverse, to back out the discount rate or growth rate implicit in market data.

After-tax EBIT adjusted for reinvestment in fixed and working capital is often used as a proxy for FCFF.

The **reinvestment rate** (or retention rate) can be calculated as follows:

$$b = g / WACC$$

$$\text{value of the firm} = \frac{EBIT_1(1-T)(1-b)}{WACC-g}$$

To estimate the value of the equity, the market value of the firm's debt is subtracted from firm value. Alternatively, the value of firm equity can be estimated using the following growing perpetuity formula:

$$\text{value of equity} = \frac{FCFE_1}{r-g}$$

The denominator in the FCFE equation is the **capitalization rate** of the CCM.

EXAMPLE: Calculating firm value using the capitalized cash flow method

Given the following figures, calculate the value of the firm and of the firm's equity using the CCM.

FCFF in one year	$12,100,000
Growth rate of FCFF	4.0%
WACC	15.0%
Market value of debt	$4,000,000

Answer:

Step 1: Calculate the value of the firm.

Using the FCFF formula:

value of firm = FCFF1 / (r – g) = ($12,100,000) / (0.15 – 0.04) = $110,000,000

Step 2: Calculate the value of the equity.

Subtract the debt value from firm value:

value of equity = firm value – debt value = $110,000,000 – $4,000,000 = $106,000,000

Note that the capitalization rate in this example is 15% – 4% = 11%. The WACC will be greater when more (relatively expensive) equity and less (cheap) debt are used, resulting in lower estimates of firm and equity values.

The Excess Earnings Method

Under the excess earnings method, the analyst starts with the earnings that *should* be generated by working capital and fixed assets, based on an estimate of the required return. Excess earnings are firm earnings minus the earnings required to provide the required rate of return on working capital and fixed assets. The value of intangible assets can be estimated as the present value of the (growing) stream of excess earnings (using the excess earnings and the growing perpetuity formula from the CCM). This value for the intangible assets is added to the values of working capital and fixed assets to arrive at firm value.

The excess earnings method (EEM) is employed only infrequently, but it can be useful for small firms when their intangible assets are significant. However, the

required return for working capital and fixed assets is subject to estimation error.

EXAMPLE: Calculating firm value using the EEM

Given the following figures, calculate the value of the firm using the EEM.

Working capital	$300,000
Fixed assets	$1,000,000
Normalized earnings (year just ended)	$130,000
Required return for working capital	6%
Required return for fixed assets	10%
Growth rate of residual income	5%
Discount rate for intangible assets	14%

Answer:

Step 1: Calculate the required return for working capital and fixed assets.

Based on the required rates of return for working capital and fixed assets, these are required earnings:

required return on working capital: $300,000 × 6% = $18,000

required return fixed assets: $1,000,000 × 10% = $100,000

Step 2: Calculate the excess earnings.

excess earnings = $130,000 − $18,000 − $100,000 = $12,000

Step 3: Value the intangible assets.

Using the formula for a growing perpetuity, the discount rate for intangible assets, and the growth rate for excess earnings, this is the value:

value of intangible assets = ($12,000 × 1.05) / (0.14 − 0.05) = $140,000

Step 4: Sum the asset values to arrive at the total firm value.

firm value = working capital + fixed assets + intangible assets

= $300,000 + $1,000,000 + $140,000 = $1,440,000

PROFESSOR'S NOTE

In the EEM, the FCFF may be given in place of the normalized earnings. The growth rate in FCF may be given in place of the growth rate of residual income. After these substitutions, the calculations are identical to those listed previously.

Market Approaches

LOS 24.i: Calculate the value of a private company using market-based methods and describe the advantages and disadvantages of each method.

Market approaches to valuing private firms use price multiples and data from previous public and private transactions. The three methods discussed here are the guideline public company method, the guideline transactions method, and the prior transaction method.

Many practitioners prefer market approaches to valuation over income and asset approaches because actual sales data is used. Although U.S. tax courts accept both market and income approaches, they usually prefer market approaches.

As discussed previously, private firms may have risks not common to public firms, such as greater company risk and illiquidity. Therefore, it is important that the public comparables be chosen carefully. Further, price multiples reflect both risk and growth. Each of these should be extracted from the price multiple and compared to the subject private firm separately to determine which adjustments might be appropriate. When choosing the comparables, commonalities in industry, operations, size, and life cycle are desirable.

Although public firms are often valued on the basis of price-earnings ratios, large private firm valuation is usually based on enterprise value multiples such as EV/sales or EV/EBITDA.

In the following discussion, we will see that an advantage of these methods is that the comparable data are usually available. The disadvantage, however, is that the comparable transactions may not be similar to the subject transaction. Issues of comparability are discussed for each of these methods in the following sections.

Guideline Public Company Method

The guideline public company method (GPCM) uses enterprise value multiples for public companies, with adjustments to the multiples to account for differences in size, leverage, and life cycle stage between the subject firm and the comparables. Although there are usually numerous public company transactions available, the data should be scrutinized to ensure that the transactions are comparable.

When evaluating a controlling equity interest in a private firm, the control premium (i.e., the value of control) should be estimated. The control premium equals the difference between the pro rata value of a controlling interest and the pro rata value of a noncontrolling interest. Most public share trades are for small, noncontrolling interests; therefore, the price multiple does not reflect a control premium.

To estimate a control premium, a public transaction should be used where a firm was acquired, and the following issues should be considered:

- *Transaction type*. Recall that a transaction may be either strategic or financial. A strategic buyer is one who will have synergies with the target, while a financial buyer is one who is buying the firm for its stand-alone value. A financial transaction typically has a smaller price premium.
- *Industry conditions*. Periodically, there is a flurry of industry acquisition activity, driving up acquisition prices. In such markets, share prices of public companies may already reflect some premium for control, so adding a standard control premium to such share prices may overstate the appropriate premium for control.

- *Type of consideration*. Some historical acquisitions will have used the acquirer's stock rather than cash. Estimates of the control premium will be overstated when acquisitions are made with shares trading at inflated ("bubble") values.
- *Reasonableness*. The use of control premiums and price multiples can sometimes compound into significant deviations from historical pricing. For example, suppose a 20% historical control premium is estimated on top of a 6x price multiple for public comparables (i.e., a multiple of 6 × 1.2 = 7.2). Later on, if the price multiple from public comparables at the valuation date is 10, a price multiple of 10 × 1.2 = 12 would then be applied to the private firm. The price multiple of 12 is substantially different from the 7.2 estimated earlier; thus, the 12 multiple should be investigated for reasonableness.
- *Multiple industries*. When using a comparables-based approach, a private company operating in multiple industries should be assigned a weighted average multiple based on the proportion of revenues generated in each industry:

  weighted average EV multiple = $\sum W_i$ multiple

  where:

  i = industry and W_i = weight of Industry i in revenues of the subject company
- *Other factors*. Additional considerations include differences in size, country, tax status, and leverage.

EXAMPLE: Valuation using the guideline public company method

An analyst, Natalie Hoskins, is valuing a private firm, Rensselaer Components (Rensselaer), using the GPCM and EV to EBITDA multiples. Hoskins has gathered data for comparable public firms indicating an average multiple of 1.18. Rensselaer operates primarily in the computer component manufacturing industry (70% of revenues), but it derives 20% and 10% of its revenues from the defense and telecom industries, respectively. The average EV/EBITDA multiple for defense and telecom industries is 1.02 and 2.45, respectively.

Rensselaer's normalized EBITDA is $12.80 million.

a. Determine an appropriate enterprise value to EBITDA multiple to be used to value Rensselaer.

b. Estimate the enterprise value for Rensselaer using EV/EBITDA.

Answer:

a. EV/EBITDA multiple = (0.70 × 1.18) + (0.20 × 1.02) + (0.10 × 2.45) = 1.28.

b. Rensselaer's estimated enterprise value = EBITDA × EV/EBITDA = 12.80 × 1.28 = $16.38 million.

Guideline Transactions Method

When using the guideline transactions method (GTM), prior acquisition values for entire companies are used. These acquisition values already reflect any control premiums, so no additional adjustment for a controlling interest is necessary (as would be the case with GPCM).

Although data about the sale of public companies is readily available, availability of information about the sale of private firms is more limited (and not always accurate). When using multiples from historical transactions, several issues should be considered:

- *Transaction type*. As mentioned previously for the GPCM, a prior transaction may be a strategic transaction where firm value was based, in part, on perceived synergies. If the subject transaction is nonstrategic, the analyst may need to adjust the historical multiple.
- *Contingent consideration*. Contingent consideration refers to that part of the acquisition price that is contingent on the achievement of specific company performance targets, such as receiving FDA approval for a drug. As contingent consideration increases the risk to the seller, transactions with contingent consideration should be scrutinized before they are compared to transactions without such contingencies.
- *Type of consideration*. As noted previously, some acquisitions are made with stock rather than cash. Comparing transactions of different consideration types may not be relevant.

EXAMPLE: Valuation with the guideline transactions method

Natalie Hoskins is valuing a private firm, Lafayette Furniture (Lafayette), for acquisition using GTM and enterprise value to EBITDA multiples. Hoskins deflates the average public company multiple by 30% to account for the higher risk of Lafayette.

Other data are as follows:

Normalized EBITDA	$18,200,000
Average EV/EBITDA multiple	7.2

Calculate the enterprise value of Lafayette using the GTM.

Answer:

The adjustment to the EV/EBITDA multiple for the higher risk of Lafayette is as follows:

$$7.2 \times (1 - 0.30) = 5.0$$

This adjusted multiple is applied against the normalized EBITDA to estimate the value of the firm:

$$5.0 \times \$18{,}200{,}000 = \$91{,}000{,}000$$

MODULE QUIZ 24.3

1. Suppose that the following financial figures relate to a small private company:

Normalized FCFE in current year	$2,200,000
Reported FCFE in current year	$1,800,000
Growth rate of FCFE	6.0%
Equity discount rate	18.0%
WACC	14.5%
Risk-free rate	4.2%
Cost of debt	11.0%
Market value of debt	$3,000,000

The value of the firm's equity using the capitalized cash flow method (CCM) is *closest* to:

A. $15,900,000.
B. $18,300,000.
C. $19,400,000.

2. Suppose that the following financial figures relate to a small firms with significant intangible assets:

Working capital	$400,000
Fixed assets	$1,800,000
Normalized earnings	$235,000
Required return for working capital	4%
Required return for fixed assets	12%
Growth rate of residual income	3%
Discount rate for intangible assets	16%

The value of the firm using the excess earnings method (EEM) is *closest* to:

A. $1,823,800.
B. $2,223,000.
C. $2,223,800.

3. An analyst has been tasked with valuing a private firm. She uses the following figures, but deflates the average public company multiple by 30% to account for the higher risk of the private firm:

Normalized EBITDA	$27,100,000
Average public company EV/EBITDA multiple	9.0

Based on the guideline public company method (GPCM), the enterprise value of the private firm is *closest* to:

A. $170,730,000.
B. $214,090,000.
C. $243,900,000.

4. An analyst is valuing the equity of a firm that has been experiencing financial distress for several months. The *most appropriate* valuation approach that the analyst might use is the:

A. market approach.
B. income approach.
C. asset-based approach.

KEY CONCEPTS

LOS 24.a

Both company-specific and stock-specific factors distinguish private and public companies.

Company-specific factors for private firms may include the degree to which they do the following:

- Are less mature
- Have less capital
- Have fewer assets
- Have fewer employees with less depth of management
- Are riskier
- Have higher managerial ownership
- Have a longer-term focus
- Provide less disclosure of information about the firm
- Have greater tax concerns

Stock-specific factors for private firms may include the degree to which they do the following:

- Have less liquidity in the equity interests
- Often have restrictions on liquidity
- Have concentration of control to the possible detriment of noncontrolling shareholders

Company-specific factors can have positive or negative effects on private company valuations, while stock-specific factors are usually negative. There is more heterogeneity in private firm risk, discount rates, and valuation methods.

LOS 24.b

Private company valuations are used for transactions, compliance, and litigation. Transaction-related valuations are performed when there is venture capital financing, an IPO, a sale of the firm, bankruptcy, or performance-based managerial compensation. Compliance-related valuations are performed for financial reporting and tax purposes. Litigation-related valuations may be required for shareholder suits, damage claims, lost profits, or divorces.

LOS 24.c

Normalized earnings are calculated by adjusting for the following:

- Nonrecurring and unusual items
- Discretionary expenses
- Nonmarket levels of compensation
- Personal expenses charged to the firm
- Real estate expenses based on historical cost
- Nonmarket lease rates

The normalized earnings for a strategic buyer incorporate acquisition synergies, whereas a financial transaction does not.

When estimating FCF to value the firm or equity, the following issues should be considered:

- Estimates may vary for controlling and noncontrolling equity interests.
- Several scenarios of future cash flows should be examined.
- The scenarios should consider the life cycle stage of the firm.
- Management biases should be anticipated.
- FCFF should be used when there will be capital structure changes.

LOS 24.d

An estimate of the discount rate in a private firm valuation should factor in the following elements:

- *Size premiums*. If an appraiser makes use of data from small-cap public firms, these may include a distress premium not applicable to the private firm being valued.
- *Availability and cost of debt*. Compared to a public firm, a private firm may not be able to obtain as much debt financing, or at as low a cost.
- *Acquirer vs. target*. The WACC used should be that of the target, not the acquirer.
- *Projection risk*. Projecting cash flows for private firms is riskier due to the lower availability of information, and because of reliance on management for projections.
- *Life cycle stage*. It can be difficult to estimate an appropriate discount rate for early-stage firms.

LOS 24.e

Models for calculating appropriate discount rates for private firms include the following:

- *CAPM*. This may be inappropriate for private firms because beta is usually estimated from public firm returns.
- *Expanded CAPM*. This adds premiums for size and firm-specific risk.
- *Build-up method*. This begins with the market rate of return (beta = 1) and adds industry risk and other risk premiums. This is used when betas for comparable public firms are not available.

LOS 24.f

Discounts and premiums to comparable company values should be applied when there are differences between the characteristics of the benchmark company and those of the target company to be valued.

A discount for lack of control (DLOC) is applied when the comparable values are for the sale of an entire company, but the valuation is for a minority interest in the target company. A control premium is added when the comparable company values are for public shares or other minority interests, but the target company valuation is for a controlling interest.

A DLOC can be estimated using valuations based on reported earnings rather than normalized earnings, or as follows:

$$\text{DLOC} = 1 - \left[\frac{1}{1 + \text{control premium}}\right]$$

Discounts for lack of marketability (DLOM) are applied when the comparables are based on highly marketable securities, such as public shares, and the interest in the target company is less marketable, as in the case of a minority interest in a private firm. The DLOM can be estimated using restricted share versus publicly traded share prices, using pre-IPO versus post-IPO prices, and using put prices. It can be challenging to implement these methods.

The DLOC and DLOM are applied multiplicatively using the following:

$$\text{total discount} = 1 - [(1 - \text{DLOC})(1 - \text{DLOM})]$$

LOS 24.g

The three major approaches to private company valuation are the income approach, the market approach, and the asset-based approach. The valuation should consider the firm's operations, life cycle stage, size, risk, and growth.

LOS 24.h

The three methods of valuation using the income approach are as follows:

- *Free cash flow method*. This discounts a series of discrete cash flows plus a terminal value. It is a two-stage model.
- *Capitalized cash flow method*. This discounts a single cash flow by the capitalization rate. It is a single-stage model.
- *Excess earnings method*. This values tangible and intangible assets separately. It is useful for small firms and when there are intangible assets to value.

LOS 24.i

The three market approach methods are as follows:

1. The *guideline public company method (GPCM)* uses price multiples from traded public companies with adjustments for risk differences. The advantage is that there are usually numerous public company transactions available, but the public firms may not be comparable. When estimating a control premium for a controlling interest, the transaction type, industry conditions, type of consideration, and reasonableness should be considered.
2. The *guideline transactions method (GTM)* uses price multiples from the sale of whole public and private companies with adjustments for risk differences. The following issues regarding the comparable data should be considered: transaction type, contingent consideration, type of consideration, availability of data, and date of data.
3. The *prior transaction method (PTM)* uses historical stock sales of the subject company and is best when using recent, arm's-length data of the same motivation.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 24.1

1. **B** Private firms can take a longer-term view because their managers/owners do not have to focus on the short-term desires of external shareholders. Private firms are more concerned with taxes because of the impact of firm policies on the taxation of the firm's owners. In most private firms, management has substantial ownership. (LOS 24.a)

2. **A** In venture capital financing, the private company valuations are usually subject to negotiation and are informal due to the uncertainty of future cash flows. (LOS 24.b)

3. **A** The buyer's analyst should reduce executive compensation by $800,000 – $650,000 = $150,000 to match market levels. Also, the lease rate should be adjusted higher by ($250,000 – $200,000) = $50,000. After the adjustments, normalized EBITDA is $6,700,000 + $150,000 – $50,000 = $6,800,000. (LOS 24.c)

4. **A** The answer is calculated as follows.

Pro Forma Income Statement	
Revenues	$10,500,000
Cost of goods sold	$8,400,000
Gross profit	$2,100,000
SG&A expenses	$1,600,000
Pro forma EBITDA	$500,000
Depreciation and amortization	$105,000
Pro forma EBIT	$395,000
Pro forma taxes on EBIT	$158,000
Operating income after tax	$237,000
Adjustments to obtain FCFF	
Plus: depreciation and amortization	$105,000
Minus: capital expenditures	$125,000
Minus: increase in working capital	$60,000
FCFF	$157,000

The following provides a line-by-line explanation for the previous calculations.

Pro Forma Income Statement	Explanation
Revenues	Current revenues multiplied by the growth rate: \$10,000,000 × (1.05)
Cost of goods sold	Revenues multiplied by one minus the gross profit margin: \$10,500,000 × (1 − 0.20)
Gross profit	Revenues multiplied by the gross profit margin: \$10,500,000 × 0.20
SG&A expenses	Given in the question
Pro forma EBITDA	Gross profit minus SG&A expenses: \$2,100,000 − \$1,600,000
Depreciation and amortization	Revenues multiplied by the given depreciation expense: \$10,500,000 × 0.01
Pro forma EBIT	EBITDA minus depreciation and amortization: \$500,000 − \$105,000
Pro forma taxes on EBIT	EBIT multiplied by tax rate: \$395,000 × 0.40
Operating income after tax	EBIT minus taxes: \$395,000 − \$158,000
Adjustments to obtain FCFF	*Explanation*
Plus: depreciation and amortization	Add back noncash charges from those listed previously
Minus: capital expenditures	Capital expenditures equal depreciation plus 4% of the firm's incremental revenues: (\$10,500,000 × 1%) + [4% × (\$10,000,000 × 5%)] = \$105,000 + \$20,000 = \$125,000
Minus: increase in working capital	The working capital will increase as revenues increase: 0.12 × (\$10,500,000 − \$10,000,000)
FCFF	Operating income net of the previous adjustments

(LOS 24.c)

Module Quiz 24.2

1. **A** The private target's WACC should be used. This may be much different than the acquirer's WACC, given that acquirers are usually larger and more mature than targets. (LOS 24.d)

2. **B** If there are no comparable public firms with which to estimate beta by, then the build-up method can be used, whereby various risk premiums are added to the risk-free rate. (The build-up model implicitly assumes a beta of one.) The CAPM and expanded CAPM methods require us to identify comparable public companies to determine a market-based beta estimate. (LOS 24.e)

3. **A** The CAPM is the most appropriate model in this instance because the private firm is mature and of similar size and firm-specific risk as the public comparable.

The CAPM calculation uses the risk-free rate, the beta, and the equity risk premium: 4.8% + 1.50(5.5%) = 13.1%.

The appropriate risk-free rate proxy is the Treasury yield—not the returns for bonds in general.

Using the expanded CAPM is not necessary here because premiums for size and firm-specific risk are not needed. The build-up method is not the best choice when the private firm has a public comparable. (LOS 24.e)

4. **C** The build-up method is appropriate when there are no comparable public firms with which to estimate beta. Because the firm is small with a high degree of firm-specific risk, risk premiums will be used for these. An industry risk premium is used in the build-up method, but not beta.

Because the firm is being acquired, we assume the new owners will use an optimal capital structure and weights in the WACC calculation. The capital structure for public firms should not be used because public firms typically have better access to debt financing.

The resulting calculations are as follows.

Using the build-up method, the risk-free rate, the equity risk premium, the small stock premium, a company-specific risk premium, and an industry risk premium are added together:

$$\begin{aligned}\text{required return on equity} &= 4.8\% + 5.5\% + 3.8\% + 2.5\% + 2.0\% \\ &= 18.6\%\end{aligned}$$

The WACC using the optimal capital structure factors in the debt to total cap, the cost of debt, the tax rate, and the given cost of equity:

$$\begin{aligned}\text{WACC} &= (w_e \times r_e) + [w_d \times r_d \times (1 - \text{tax rate})] \\ &= (0.85 \times 18.6\%) + [0.15 \times 10\% \times (1 - 35\%)] = 16.8\%\end{aligned}$$

(LOS 24.e)

5. **C** An IPO will increase liquidity and, thus, decrease the DLOM. Lower asset risk should result in less value uncertainty and a lower DLOM. A smaller pool of buyers would result in reduced liquidity and a higher DLOM. (LOS 24.f)

6. **A** The discount for lack of control (DLOC) can be backed out of the control premium:

$$\text{DLOC} = 1 - \left[\frac{1}{1 + \text{control premium}}\right]$$

$$\text{DLOC} = 1 - \left[\frac{1}{1 + 0.18}\right] = 15.25\%$$

The total discount also uses the DLOM:

$$\text{total discount} = 1 - [(1 - \text{DLOC})(1 - \text{DLOM})]$$

$$\text{total discount} = 1 - [(1 - 0.1525)(1 - 0.22)] = 33.9\%$$

(LOS 24.f)

Module Quiz 24.3

1. **C** We can estimate the value of the equity by capitalizing the free cash flows to equity using the required return on equity (r) and the FCFE growth rate (g):

$$\text{value of equity} = \frac{\text{FCFE}_1}{r-g}$$

$$\text{value of equity} = \frac{\$2{,}200{,}000 \times 1.06}{0.18-0.06} = \$19{,}433{,}333$$

Note that we grow the FCFE by g because the *current* year (not coming year) FCFE is provided. We use normalized earnings, not reported earnings, because normalized earnings are more relevant to the acquirers of the firm. The relevant required return for FCFE is the equity discount rate, not the WACC.

An alternative approach to calculate the value of the equity would be to subtract the market value of the firm's debt from total firm value. However, the FCFF are not provided, so a total firm value cannot be calculated. (LOS 24.h)

2. **C** The value of the firm can be calculated using the following steps:

Step 1: Calculate the required return for working capital and fixed assets.

Given the required returns as a percentage, the monetary returns are as follows:

working capital = \$400,000 × 4% = \$16,000

fixed assets = \$1,800,000 × 12% = \$216,000

Step 2: Calculate the residual income.

After the monetary returns to assets are calculated, the residual income is that which is left over in the normalized earnings:

residual income = \$235,000 – \$16,000 – \$216,000 = \$3,000

Step 3: Value the intangible assets.

Using the formula for a growing perpetuity, the discount rate for intangible assets, and the growth rate for residual income, this is the value:

value of intangible assets = (\$3,000 × 1.03) / (0.16 – 0.03) = \$23,769

Step 4: Sum the asset values to arrive at the total firm value.

The firm value = \$400,000 + \$1,800,000 + \$23,769 = \$2,223,769.

(LOS 24.h)

3. **A** The adjustment to the EV/EBITDA multiple for the higher risk of the private firm is as follows:

$$\text{adjusted EV/EBITDA} = 9.0 \times (1 - 0.30) = 6.3$$

$$\begin{aligned}\text{Applying the multiple: EV} &= \text{EBITDA} \times \text{EV/EBITDA} \\ &= 27{,}100{,}000 \times 6.30 \\ &= \$170{,}730{,}000\end{aligned}$$

(LOS 24.i)

4. **C** The analyst is most likely to use the asset-based approach, which values a firm as its assets minus liabilities. The firm's future cash flows are uncertain, and it may have to be liquidated, given its distress. Therefore, the income approach should not be used, and the firm should not be compared to other firms that are going concerns, as in the market approach. The amount that equity holders could reasonably expect is their claim after liabilities have been satisfied. (LOS 24.g)

Topic Quiz: Equity Valuation

You have now finished the Equity Valuation topic section. Please log into your Schweser online dashboard and take the Topic Quiz on this section. The Topic Quiz provides immediate feedback on how effective your study has been for this material. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow three minutes per question.

FORMULAS

Equity Valuation

Gordon growth stock valuation model: $V_0 = \frac{D_0 \times (1+g)}{r-g} = \frac{D_1}{r-g}$

Two-stage stock valuation model:

$$V_0 = \left[\sum_{t=1}^{n} \frac{D_0(1+g_S)^t}{(1+r)^t}\right] + \left[\frac{D_0 \times (1+g_S)^n \times (1+g_L)}{(1+r)^n \times (r-g_L)}\right]$$

Value of perpetual preferred shares: $V_p = \frac{D_p}{r_p}$

Present value of growth opportunities: $V_0 = \frac{E_1}{r} + \text{PVGO}$

H-model: $V_0 = \frac{D_0 \times (1+g_L)}{r-g_L} + \frac{D_0 \times H \times (g_S - g_L)}{r-g_L}$

Sustainable growth rate:

$$g = \left(\frac{\text{net income} - \text{dividends}}{\text{net income}}\right) \times \left(\frac{\text{net income}}{\text{sales}}\right) \times \left(\frac{\text{sales}}{\text{total assets}}\right) \times \left(\frac{\text{total assets}}{\text{stockholders' equity}}\right)$$

Value with free cash flow models:

firm value = FCFF discounted at the WACC

equity value = FCFE discounted at the required return on equity

Free cash flow to the firm and free cash flow to equity:

FCFF = NI + NCC + [Int × (1 − tax rate)] − FCInv − WCInv

FCFF = [EBIT × (1 − tax rate)] + Dep − FCInv − WCInv

FCFF = [EBITDA × (1 − tax rate)] + (Dep × tax rate) − FCInv − WCInv

FCFF = CFO + [Int × (1 − tax rate)] − FCInv

FCFE = FCFF − [Int × (1 − tax rate)] + net borrowing

FCFE = NI + NCC − FCInv −WCInv + net borrowing

FCFE = CFO − FCInv + net borrowing

Forecast FCFE = NI − [(1 − DR) × (FCInv − Dep)] − [(1 − DR) × WCInv]

Weighted average cost of capital: $\text{WACC} = (w_e \times r) + [w_d \times r_d \times (1 - \text{tax rate})]$

Single-stage FCFF model: $\text{value of the firm} = \frac{\text{FCFF}_1}{\text{WACC} - g} = \frac{\text{FCFF}_0 \times (1+g)}{\text{WACC} - g}$

Single-stage FCFE model: $\text{value of equity} = \frac{\text{FCFE}_1}{r-g} = \frac{\text{FCFE}_0 \times (1+g)}{r-g}$

Price multiples:

$$\text{trailing P/E} = \frac{\text{market price per share}}{\text{EPS over previous 12 months}}$$

$$\text{leading P/E} = \frac{\text{market price per share}}{\text{forecasted EPS over next 12 months}}$$

$$\text{P/B ratio} = \frac{\text{market value of equity}}{\text{book value of equity}} = \frac{\text{market price per share}}{\text{book value per share}}$$

$$\text{P/S ratio} = \frac{\text{market value of equity}}{\text{total sales}} = \frac{\text{market price per share}}{\text{sales per share}}$$

$$\text{P/CF ratio} = \frac{\text{market value of equity}}{\text{cash flow}} = \frac{\text{market price per share}}{\text{cash flow per share}}$$

where:
cash flow = CF, adjusted CFO, FCFE, or EBITDA

$$\text{EV/EBITDA ratio} = \frac{\text{enterprise value}}{\text{EBITDA}}$$

$$\text{trailing D/P} = \frac{4 \times \text{most recent quarterly dividend}}{\text{market price per share}}$$

$$\text{leading D/P} = \frac{\text{forecasted dividends over next four quarters}}{\text{market price per share}}$$

Justified P/E multiples:

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{D_0 \times (1+g) / E_0}{r-g} = \frac{(1-b) \times (1+g)}{r-g}$$

$$\text{justified leading P/E} = \frac{P_0}{E_1} = \frac{D_1 / E_1}{r-g} = \frac{1-b}{r-g}$$

Justified P/B multiple:

$$\text{justified P/B ratio} = \frac{ROE - g}{r-g}$$

Justified P/S multiple:

$$\text{justified } \frac{P_0}{S_0} = \frac{(E_0/S_0) \times (1-b) \times (1+g)}{r-g}$$

Justified P/CF multiple:

$$V_0 = \frac{FCFE_0 \times (1+g)}{r-g}$$

Justified dividend yield:

$$\frac{D_0}{P_0} = \frac{r - g}{1 + g}$$

PEG ratio:

$$\text{PEG ratio} = \frac{\text{P/E ratio}}{g}$$

Weighted harmonic mean:

$$\text{weighted harmonic mean} = \frac{1}{\sum_{i=1}^{n} \frac{w_i}{X_i}}$$

Residual income:

$$RI_t = E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$$

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$

$$g = r - \left[\frac{B_0 \times (ROE - r)}{V_0 - B_0}\right]$$

Economic value added:

EVA = NOPAT − $WACC

NOPAT = EBIT × (1 − t) = (sales − COGS − SGA − dep) × (1 − t)

$WACC = WACC × total capital

total capital = net working capital + net property, plant, and equipment
= long-term debt + stockholders' equity

Private company beta estimate using comparable public company:

$$\beta_{\text{unlevered}} = \frac{\beta_{\text{public}}}{\left[1 + (1 - t)\left(\frac{D}{E}\right)\right]}$$

$$\beta_{\text{private company}} = \beta_{\text{unlevered}}\left[1 + (1 - t^*)\left(\frac{D}{E}\right)^*\right]$$

Discount for lack of control:

$$\text{DLOC} = 1 - \left[\frac{1}{1 + \text{control premium}}\right]$$

Total discount for DLOC and DLOM:

total discount = 1 − [(1 − DLOC)(1 − DLOM)]

Capitalized cash flow method:

$$\text{value of the firm} = \frac{FCFF_1}{WACC - g}$$

$$\text{value of the firm} = \frac{EBIT_1(1 - T)(1 - b)}{WACC - g}$$

$$\text{value of equity} = \frac{FCFE_1}{r - g}$$

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